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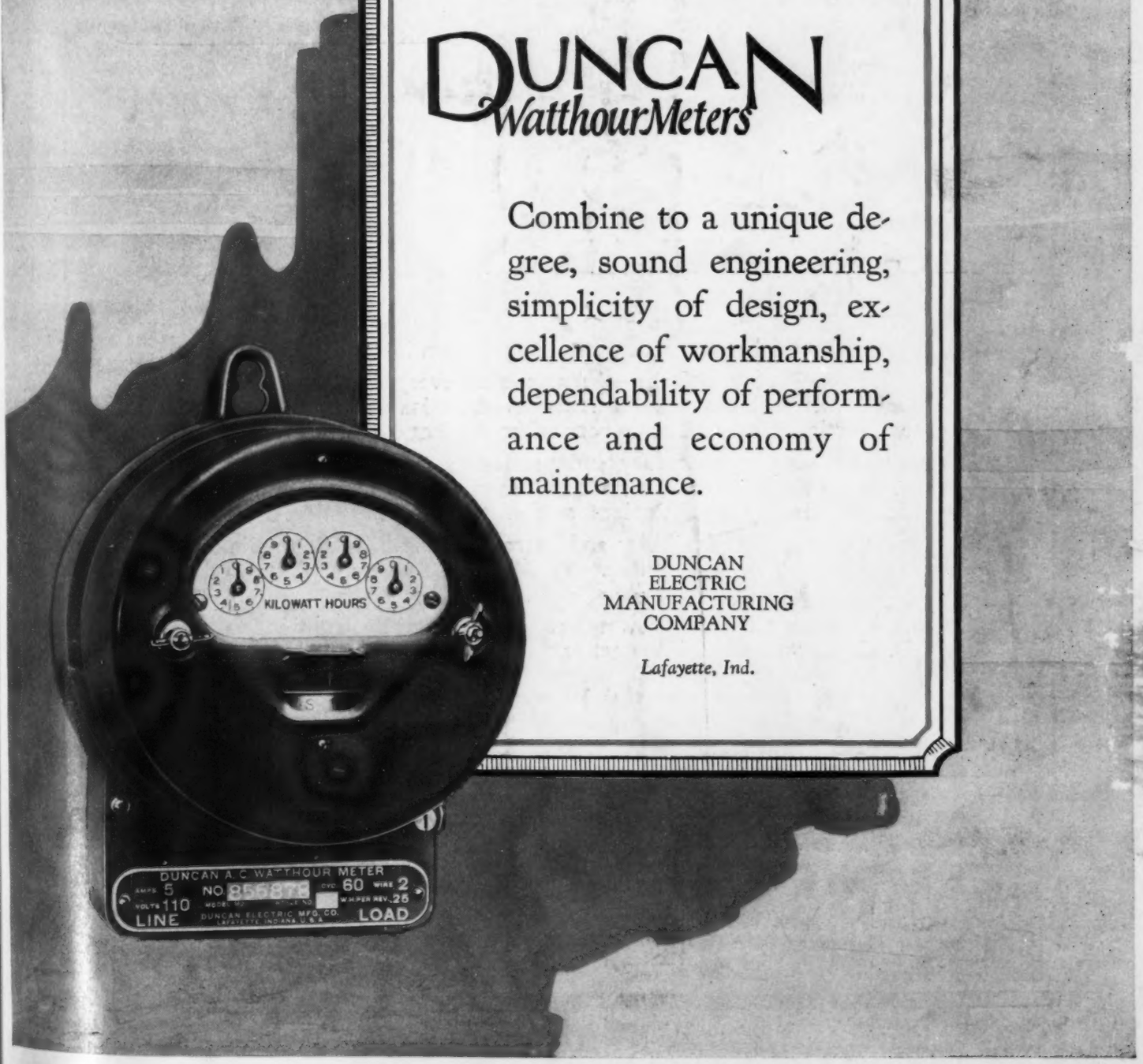

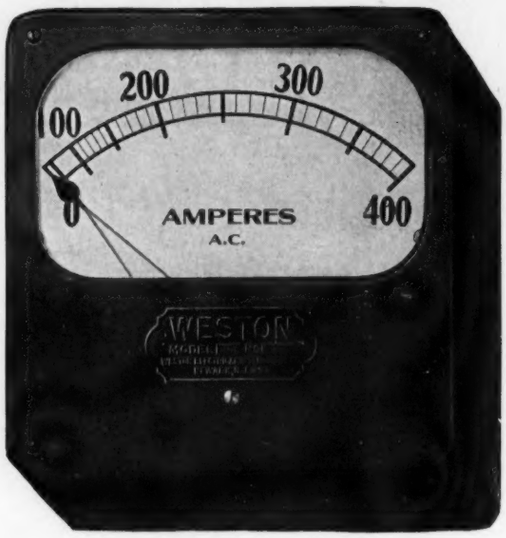

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Electrical World

Published by McGraw-Hill Company, Inc.
W. H. ONKEN, JR.
Editor

VOLUME 86 — *New York, Saturday, August 1, 1925* — NUMBER 5

National Museum of Engineering and Industry

THE United States has some of the greatest museums of the world wherein are treasured works of art, relics of older civilizations and specimens representing developments in natural history. But it has no real museum of engineering and industry wherein are preserved those notable developments which have made modern industrial civilization.

Any movement to establish such a museum should be welcomed and heartily supported, and the 1924 incorporation of interested leaders of industry has made notable progress toward the goal. Under the direction of Samuel Insull as president of the corporation this year it is planned to have Congress provide funds to erect a museum building in Washington. The Washington museum will be under the direction of the Smithsonian Institution and will afford a safe and permanent location for preserving the complete record of the development of engineering and industry in general. Too long has this country postponed a job which has been accomplished already by several European countries. There should be this element of national appreciation of engineering and industry in a nation which has established world leadership in these directions.

Stock Market Quotations and Public Utility Rates

THERE appears to be a misconception on the part of many people about the powers of public service commissions over the sale of electric light and power company stocks. This has manifested itself not only in New York but also in Wisconsin, California, and other states, and while public utility companies may not view this state of the public mind with any seriousness, the fact that it exists indicates the need of public education and explanation. So important did the matter appear to the Wisconsin Railroad Commission recently that it issued a public statement on the sale of the Wisconsin Public Service Corporation to the Byllesby interests, explaining what actually took place.

In ordinary business any one who secures a majority of the common stock of a corporation controls the activities of that corporation. He assumes all the risks and responsibilities, and it depends on his skill and enterprise whether the business is conducted with profit or at a loss. Naturally if the venture be unprofitable the holders of common stock receive no interest on their investment, and if bond interest is not paid the corporation falls into the hands of receivers. Now it makes no difference whether the common stock is that of an industrial corporation or a public utility company. If its stock is salable on the open market any one can purchase it and the price paid is of no concern to any one except the purchaser. In the public utility business if one pays more for the stock than it is worth, that is his misfortune. Commissioners do not predicate rates on stock values; but on the investment honestly and prudently made in the business. Thus the public is protected on rates paid for service and need not concern itself unduly on stock market quotations. If a utility earns more than a fair return on its investment, rate reductions are in order, and experience shows that public service commissions are not slow in acting on the public behalf.

Kva. Versus Kw. as Basis for Rating

WHEN manufacturers began to rate alternating-current generators on the kva. basis with a supplemental kw. rating at a certain power factor, it appeared that the question of whether kw. or kva. is the proper basis for rating alternating-current equipment was on the road to settlement. However, there arises on various sides the argument that kw. is the proper basis—that kva. gives a false conception of the capacity available. There is something to be said for both sides of the argument, but it remains for the industry to decide whether all the information desired is not contained in the kva. rating.

What are the arguments for a kw. rating of alternating-current equipment? One is that prime movers are seldom if ever installed to develop a kw. output equal to the kva. rating of the generator. Hence kva. rating gives a false conception of the amount of capacity available in a specific unit, group of units or in the whole country; or in connection with a transmission line the kw. basis of rating gives the total load in kw. that can be carried.

Is it not forgotten, though, by those who put forth these arguments that kw. ratings are based on assumed power factors? The base power factor may be different in different cases, so that when kw. figures are treated collectively there is, figuratively, a mixture of pears, apples and peaches rather than all apples—and different units cannot be added, subtracted, divided or multiplied. Furthermore, is the kw. rating the maximum safe rating if the power factor is different from that on which the rating is based? Is it not confusing in dealing with the comparative ratings of related equipment to have two kinds of ratings which may be at different power factors?

With a kva. rating for all equipment, no one would have to bother about power factor so long as the kva. load was kept within the limits of the rating, since the maximum kva. rating is determined by the heating effect. Such a rating would tell definitely the maximum load which could be carried by the equipment regardless of power factor. If the kw. rating of alternating-current equipment was wanted at any time, it could be easily determined by multiplying by the actual and

not the assumed power factor. With direct-current equipment the rating would be the same in kw. as in kva. Kva. rating is also a truer measure of the investment in equipment than kw. If the kva. rating was not entirely taken up by load, it would indicate definitely how much margin was left for carrying wattless load or magnetizing current. A comparison of the kilowatt-hours delivered by equipment with the kilovolt-ampere-hours which could be delivered if the equipment were in maximum use all the time would serve to emphasize strikingly the need of correction of power factor or increased use of equipment, thus permitting greater return on the investment.

Whatever the facts are, there will be benefit to every individual in analyzing the pros and cons. It will possibly be found that what is best for the operating man or engineer will not be best for the statistician. If this is the case, design and operation should have prior rights and the statistician will have to fit his needs into their requirements.

Setting a Better Balance in Steam Plant Design

ATTENTION has been sharply focussed so long upon the B.t.u. economies of steam-generating plants that the importance of overhead costs has often been unrealized by engineers in general, not to say by many central-station technical men. A study of the growing significance of "overheads" in steam plant economy indicate that the time has arrived to scrutinize with a critical financial eye features of plant design aimed to reduce operating expenses and to take greater care than ever to justify added investments of this kind. Further gains in plant economy will cost so much in increased overheads that a thorough engineering and economic audit should always be carried through to the logical conclusion before such improvements are authorized. The wiser heads in the industry have been practising along this line for many years, and a great deal of good should come from a more general conception that this practice is good business and that real economy in plant design means a minimum total cost per unit of output.

Ground Potentials in the Vicinity of Transmission Towers

CASES of electric shock to persons and animals in the vicinity of high-tension transmission towers and substations have been reported from time to time. In certain kinds of soils it is difficult to obtain a low-resistance ground connection at each tower without prohibitive expense. Thus, under abnormal conditions, when one of the live conductors touches the tower the drop of potential may extend over a considerable area of ground, and with a combination of unfavorable circumstances dangerous shocks to passers-by may occur.

The last annual report of the A.I.E.E. committee on protective devices contains an account of tests on a 120-kv. tower, and the results show that the ground potential near the tower is dangerously high when a line conductor becomes grounded to the tower. Where such towers are near a highway or an inhabited place, as a matter of precaution and in the interest of safety they should be thoroughly connected to the nearest station ground by means of an overhead ground wire.

Power-Factor Correction Popular

DURING the past year there has developed a widespread interest in the economic and engineering aspects of power-factor correction. Many meetings have been held, a number of papers and reports have been presented, a multitude of articles have been published and active discussions have been had throughout the land. The result is a very widespread interest in the topic, the formulation of many opinions and the creation of a national attitude of mind that is at least attentive, if not receptive, to the idea of power-factor correction.

The task is to continue this interest and attitude of mind a sufficient time for the whole subject to shake down into something definite, positive and general in its application. If every utility man, industrial plant man, motor salesman and others concerned with electrical installations will bring up the question of power factor in connection with every plan and every job worth while results are sure to follow.

No general rate clause, no general solution as to method of correction, no general agreement as to the best corrective equipment are necessary or even advisable at this time. The subject is in a state of flux and the less artificial tinkering is done the quicker real conclusions will be reached. Nearly every one is agreed that correction can be made in individual cases where economic and engineering analyses show its value. The important thing is to have these analyses made and acted upon in sufficient numbers to give real data upon which to make general conclusions and expedite power-factor correction in its economic applications.

Light Production Efficiency Is Low But Electric Lighting Is Inexpensive

IT IS a well-known scientific fact that the absolute efficiency of our present methods of producing artificial light is quite low. However, the statement of this isolated fact is very misleading and the idea of relative values should be introduced into such discussions. For example, a scientific writer recently stated that "to light a lamp as a source of light is about as wasteful as to burn down one's house to roast one's pork." We might pass such a statement by, allowing for a certain degree of exaggeration as being justifiable for the sake of emphasis. However, the statement and its context creates a wrong impression because relative value has been ignored.

Regardless of the low absolute efficiency of light production at the present time we should not overlook several other facts. Artificial light now costs only about one-fiftieth as much as it did before the electrical age began. Furthermore, when the great value of artificial light in homes, offices, factories and in transportation is considered and compare this with its relatively insignificant cost, the conclusion must be that artificial light is cheap regardless of its low absolute efficiency of production.

The same writer goes on to emphasize the desirability of cheaper electricity. Why did he not prophesy an eventual enormous increase in the efficiency of light production? The theoretical possibilities in this direction viewed absolutely are still very extensive. Perhaps he unconsciously recognized that during the present century those working in the field of light production efficiency have greatly outstripped those in the field

of electrical-energy production. Of course, there has been commendable progress in the production of electrical energy efficiently, but it is a fact that the great decrease in the cost of the electric light during the past three decades is largely due to increases in the efficiency of light production rather than to comparable decreases in the cost of electrical energy. We may rest assured that improvements along both lines are bound to come, and in the meantime we need not worry over the low absolute efficiency of light production, for electric light is already very cheap when we consider its relative value.

Telling Employees About Rate Cases

AN INTERESTING departure from the old-time policy of keeping rate case discussions strictly within the executive, legal, accounting and engineering circles directly concerned in a public utility was made by the New England Telephone & Telegraph Company in recent proceedings before the Massachusetts commission. In its publication, "Telephone Topics," the company took pains to acquaint its many thousands of employees regularly with the progress of its application for increased rates, summarizing the evidence and arguments advanced as the case went forward in such a way that every man and woman on the payroll might easily obtain an intelligent idea of the company's position, and follow the general course of affairs sufficiently to show real understanding of the situation when off duty and among the public outside the "shop." Nor was the story confined to company witnesses. Courteous attention was given to the contentions of opponents, and the company's position in reply was made clear. All told, an excellent job was done in the line of employee education along rather new channels, and it is a reasonable assumption that in conducting rate cases of more than minor importance electric light and power executives will do well to take a leaf out of the New England company's book.

Ultra-Audible Waves and Their Applications

WHAT is known as sound waves are longitudinal vibrations of a body (gas, liquid or solid) within the audibility range of human beings. Because this audibility ceases, for purely physiological reasons, at an upper limit of frequencies somewhere between 10,000 and 20,000 cycles per second, there is no reason why such longitudinal vibrations of much higher frequencies could not be produced, propagated and received by means of suitable detectors. In *La Révue Hydrographique* for November, 1924, there is a description of complete apparatus for sending and receiving such super-sound waves under water at frequencies between 40,000 and 100,000 cycles per second. The apparatus is purely electrical, piezo-electric properties of quartz and a three-electrode oscillating vacuum tube being utilized. The time elapsed between the sending of a signal and the reception of an echo determines the distance to the object against which a reflection took place.

Among the interesting properties of such ultra-audible waves are the following: (1) The emitted power can be made quite large; in the first experimental device it was of the order of magnitude of one kilowatt and the fishes in its path were killed; (2) losses by dispersion are quite small, the pencil of waves remaining of nearly the same cross-section for quite a considerable distance and the intensity decreasing mainly through absorption; (3) the velocity of propagation being that of sound (332 m. per second in air and 1,480 m. per second in water), a reflected wave reaches the sending point after an interval of time sufficiently long to be recorded by quite simple means.

Probably in time such ultra-audible waves will become of increasing scientific and practical value, and engineers should turn their attention to possible useful applications. As such, the following have either already been demonstrated or are within possibility: (a) Sounding of the ocean bottom and of riverbeds for geological and hydrographic purposes, navigation, laying of cables, etc.; (b) location of other vessels, icebergs, shore line, etc., in fog or at night; (c) killing of fish, with possible extension of the method of extermination of insect pests; (d) improvement in hearing of deaf persons while the eardrum is being agitated by ultra-audible waves; (e) extension of the range of oral communication by using super-sounds as carrier waves; (f) determination of the speed of a rapidly moving object, for example a motor vehicle, for proving a speed law violation, etc.

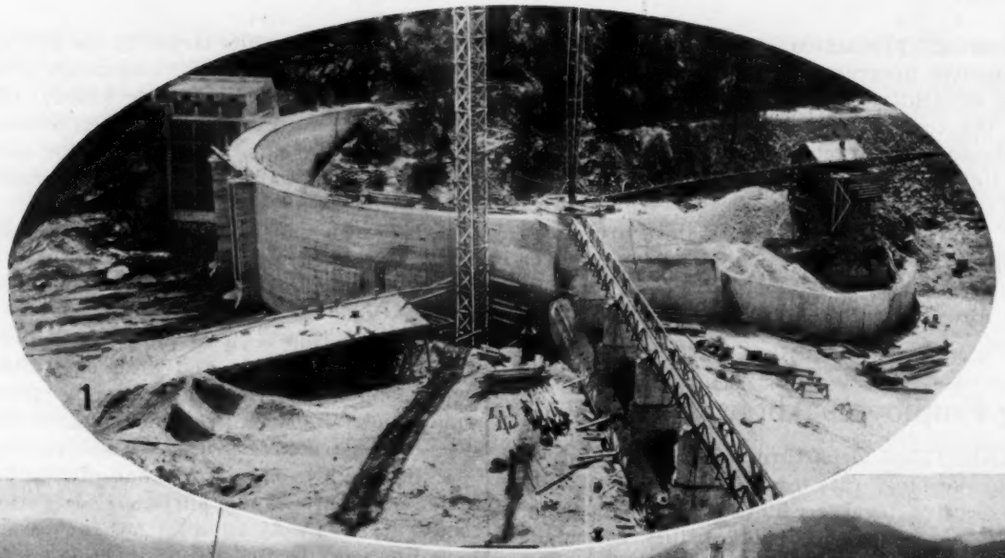
Paying the Price of Inexperience

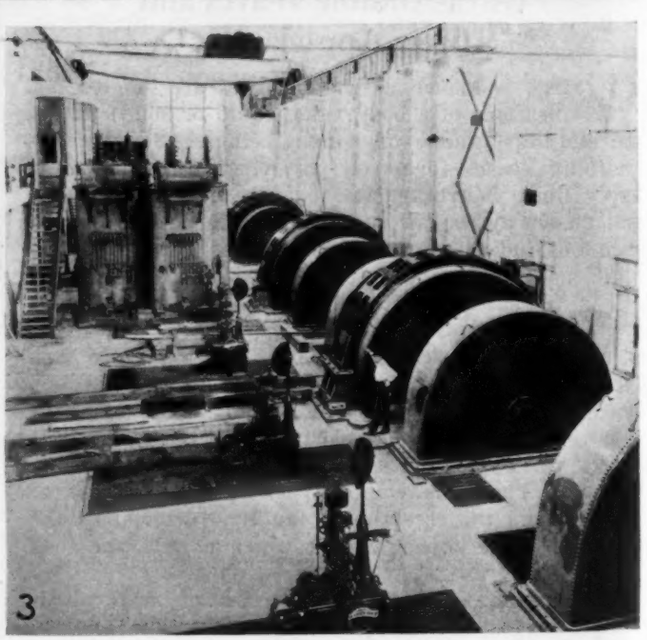
WHAT can happen to a modern hydro-electric plant in the hands of inexperienced operators was well demonstrated at the Moccasin power house of the city of San Francisco recently, when two penstocks were ruptured by water hammer and damage to a new plant to the extent of $25,000 was done. The primary cause of the accident (see news columns of this issue for full account) was failure on the part of the operator to by-pass a large hydraulically operated gate valve before opening it. The gate valve opened in a fraction of the time it should have taken and allowed water to rush into an empty section of pipe, setting up a terrific water hammer.

Hydraulically operated gate valves may be used and are used on heads as high as the 1,300 ft. encountered in this plant, but where such valves are used the manufacturers and the operators should have a thorough knowledge of the hydro-electric design and operating requirements. It should be possible for manufacturers of valves to make them more foolproof by fixing the timing for each installation or by other means that will not place equipment at the mercy of careless operators.

The accident shows the dangers of starting up a hydro-electric plant before all equipment is in operating condition. The motor controls to the butterfly valves at the head of the penstocks had not been installed, and it was more than an hour before the valves could be closed by an improvised method of using an air hammer. During this time a torrent of water and débris was surging down into the power house, doing damage to the extent of thousands of dollars.

The lessons to be learned from the Moccasin plant experience can well be applied by all interested in the design, construction and operation of hydro-electric plants.





Hetch Hetchy Development in Operation

ACTING under the Raker act, the city of San Francisco has invested upward of $55,000,000 in the water and power development of Hetch Hetchy. The initial rating of the Moccasin power house is 80,000 kva. and the reservoir has a present storage capacity of 206,000 acre-feet. The energy from the power house is transmitted 98.5 miles over a 115-kv. line to the San Francisco bay region. The Raker act forbids the wholesaling of power from the development and present plans contemplate selling it to the Pacific Gas & Electric Company.

Fig. 1—Early Intake diversion works.
Fig. 2—Moccasin power house, with a capacity of 80,000 hp.
Fig. 3—Interior of Moccasin power house, showing four 20,000-kva., 11,000-volt, 257-r.p.m. generators.

The Hetch Hetchy Power Development

City of San Francisco Installs 80,000-Kva. Power Plant in Conjunction with Domestic Water Supply —Electrical and Hydraulic Features Are Described

By M. M. O'SHAUGHNESSY
City Engineer, San Francisco, Cal.

THE FIRST power unit on the widely known Hetch Hetchy municipal water and power project of the city of San Francisco is now completed and is delivering electrical energy to San Francisco. The Moccasin power plant, which was placed in operation during the past month, has four units with a total rated capacity of 80,000 kva., and provision has been made for the addition of two more units. Water for operation of the plant is stored by the O'Shaughnessy dam on the upper reaches of the Tuolumne River, in Yosemite National Park. Twelve miles below this dam is located a diversion works, where the water is diverted through a tunnel 18.8 miles in length to the power house. From the tailrace at the power house a 137-mile aqueduct will convey the water to San Francisco for domestic use.

HYDRAULIC FEATURES

As just stated, water is stored in a reservoir known as Hetch Hetchy created by the O'Shaughnessy dam. The capacity of this reservoir is 206,000 acre-ft. at present and the dam will be raised in the future to store 348,000 acre-ft. from a watershed of 459 square miles. The water released from Hetch Hetchy flows down the Tuolumne River canyon 12 miles to Early Intake, the starting point of the 18.8-mile tunnel. It is planned in the future to build a 12-mile tunnel from Hetch Hetchy to Early Intake with a 60,000-hp. plant the tailrace of which will discharge into the pond at the tunnel intake. Other future plans involve the construction of an aqueduct 8½ miles long from Lake Eleanor to a power drop at North Mountain, where a 40,000-hp. plant will be installed to discharge its water into the river about a mile above Early Intake.

INTAKE DIVERSION WORKS

At Early Intake the diversion dam (see Fig. 1) consists of a thin concrete arch 262 ft. long and a concrete spillway 130 ft. long. On the left bank is the aqueduct intake tower with gates regulating the flow of water, which is led through the 18.8-mile tunnel to the power house. The diversion dam has a height above river bed of 55 ft. and extends 25 ft. down to solid granite. The upstream radius of the dam is 100 ft. On the south the arch abuts the granite canyon wall and on the north is a concrete block. From this block the spillway extends northerly and is divided by piers into five sections, each 23 ft. long. In these sections automatic radial gates have been installed to maintain the water surface 5 ft. above the lip of the spillway.

A siphon arrangement automatically lowers these gates to pass excess floods and permits them to rise after the flood has subsided. The details of these siphon gates is shown in Fig. 4. The gate tower at the intake is equipped with fixed grillage to catch heavy refuse and with wire mesh manually operated traveling screens to catch leaves and light refuse. Sand chambers in front of the screens discharge through the dam. There are nine sluice gates, 4x5 ft., five in the lower tier and four in the upper. A concrete house covers the operating wheels, screen mechanism, etc., the whole being protected from falling rocks from the adjacent mountainside by a reinforced concrete guard wall.

TUNNEL, FOREBAY, SURGE CHAMBER

From the diversion dam an 18.8-mile tunnel conveys the water to the Priest regulating reservoir, near the power house. The first 7½ miles of the tunnel is

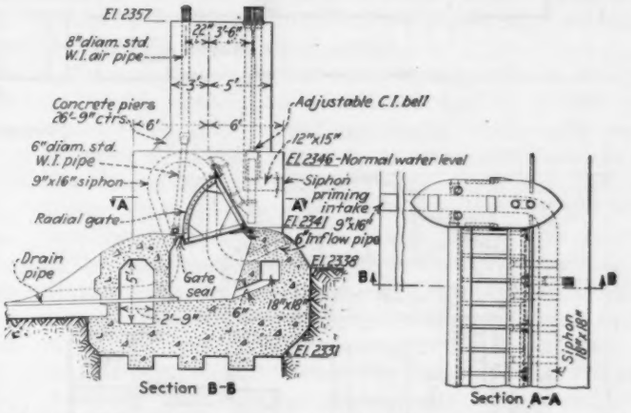


FIG. 4—DETAILS OF SIPHON SPILLWAY GATES FOR FLOOD CONTROL

excavated to 13 ft. 6 in. x 13 ft. 4 in., with arched top and bottom. This section of the tunnel is unlined. The remainder of the tunnel (see Fig. 6) is of horseshoe shape 10 ft. 3 in. high by 10 ft. 3 in. wide, with a net area of 87.94 sq.ft. inside the lining. This section is lined throughout with 1:2½:4½ concrete with a minimum thickness of 6 in. The grade is about 8 ft. per mile and the capacity of the tunnel is 620 sec.-ft.

The Priest regulating reservoir, the forebay for the power plant, was made by constructing an earth-fill dam with concrete core wall across a creek. The dam is 1,160 ft. long and 147.5 ft. high and creates a storage reservoir of 2,600 acre-ft. capacity, or more than two days' flow of the tunnel, Water released from the reservoir to the power house enters a tunnel through a concrete inlet control tower. Regulation of the water is effected by six electrically operated sluice gates, 6x8 ft. Manual operation is also possible, and steel shutters are provided for isolating any set of four gates for repairs if necessary. Fixed screens with manually operated cleaners prevent fine trash from entering the tunnel.

The tunnel from the forebay to the surge chamber is 5,300 ft. long. The tunnel section is 141.47 sq.ft., with a grade of 6 ft. per 1,000 ft., making its capacity 1,240 sec.-ft. without excessive loss of head. This tunnel enters a surge shaft 40 ft. in diameter and 160 ft. high, from the further face of which branch the three penstock pipes imbedded in concrete in tunnels 535 ft. long. The surge shaft is designed to handle surges of from 35 to 40 ft., and projects 48 ft. above the ground. The walls of this portion range in thickness from 24 to 10 in. and contain heavy reinforcement (see Fig. 7) the maximum of which is two rings of 1½-in. square bars staggered at 7-in. centers. Accumulation of external water pressure below the ground surface, which might result from surface runoff, is prevented by a system of porous cement drain tile.

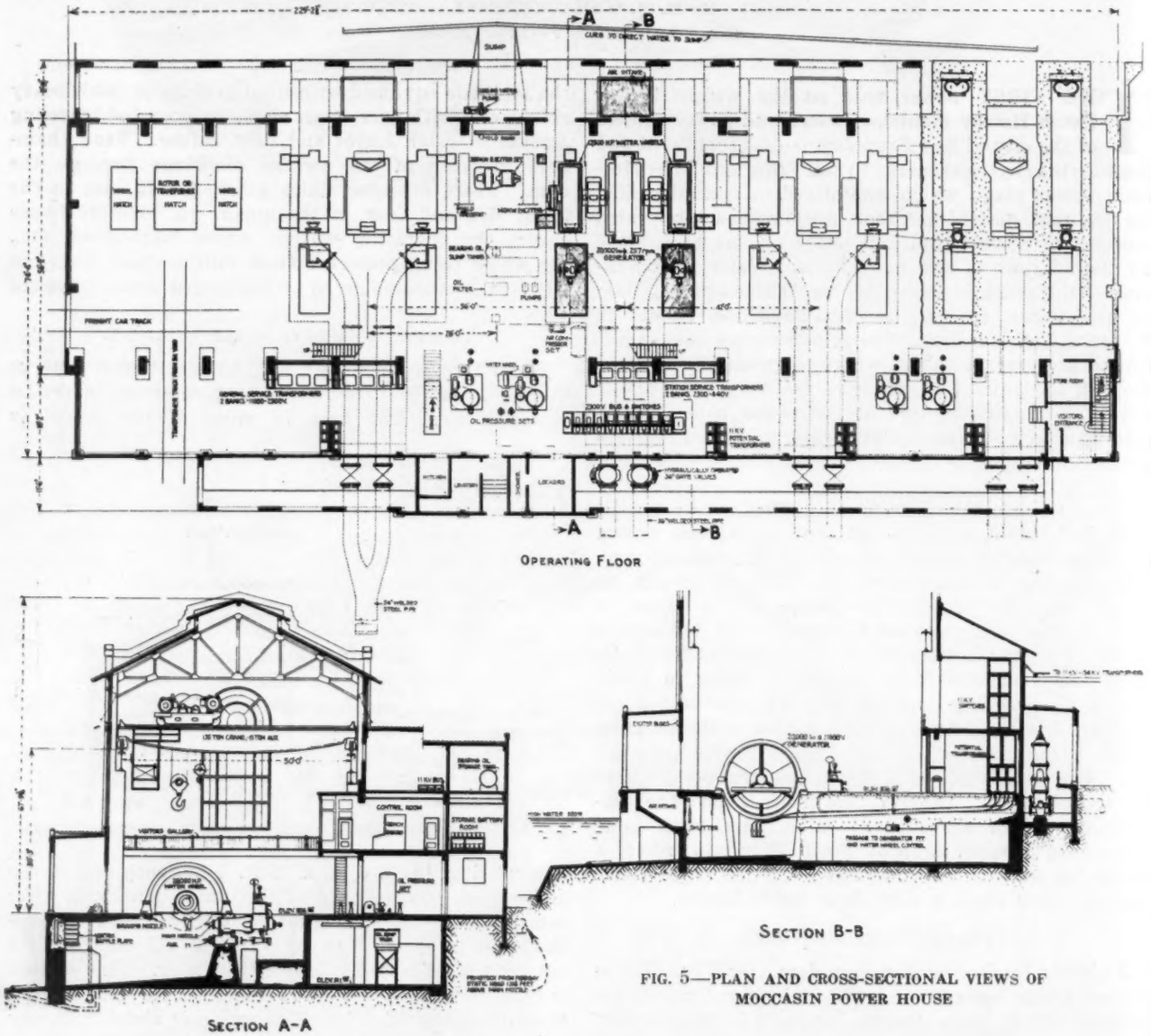


FIG. 5—PLAN AND CROSS-SECTIONAL VIEWS OF MOCCASIN POWER HOUSE

PENSTOCKS

The three penstocks, of which the horizontal length is 5,369 ft., begin at the surge chamber. For a distance of approximately 500 ft. the three 104-in. steel pipes run through tunnels. About 50 ft. down the slope toward the power house from the portal of these tunnels are located 104-in. butterfly valves. One of the pipes is capped for future extension when two more generators shall have been installed in the plant. The butterfly valves are motor operated and are arranged for closing by remote control from the power house, nearly 5,000 ft. distant. As a matter of safety, opening cannot be done by remote control. Each pipe is fitted with two sets of four 8-in. air valves.

The thickness of the penstocks at the surge chamber is $\frac{3}{8}$ in. At a slope distance of 1.011 ft. from the surge chamber the diameter reduces to 98 in., and the double-riveted lap joints change to triple-riveted butt joints. At a slope distance of 2,111 ft. each penstock branches into two 66-in. pipes (see Fig. 8) with longitudinal seam hammer-forge-welded pipe with "bumped" joints of enlarged section to obviate any obstruction to water flow by rivet heads. The welded pipes range in diameter from 66 to 54 in., and in thickness from $\frac{7}{16}$ to $1\frac{7}{16}$ in. Immediately before entering the power house the four 54-in. pipes branch each into two 36-in. pipes. Each of these pipes is provided with an extra heavy, hydraulically operated valve set in the power house arcade. One of these valves is shown in Fig. 9.

The heaviest pipe weighs approximately 26,000 lb. The 30-ft. lengths are supported on concrete piers or

saddles built in advance of the pipe laying. At angles, of which there are twenty, either horizontal, vertical or combined, the pipes are held securely by concrete anchors. The largest of these contains 839 cu.yd. of concrete and 7.64 tons of reinforcing steel. At the 98x66-in. wye branch is a special sliding anchor in which the upper portion, inclosing the pipes, can slide on bronze plates imbedded in the fixed concrete of the lower portion.

Moccasin Power House

All generating equipment in the Moccasin power house is housed within a steel-frame building with light reinforced concrete walls and a concrete roof. The design of the building is of the well-known California Mission type. The structure is 225 ft. long by 98 ft. wide and is 68 ft. in height above the generator floor. The height from the basement floor to the generator floor is 15 ft., providing ample room for installation, inspection and maintenance of the hydraulic equipment. Each side of the building has an arcade; the one on the tailrace side provides for the intake of cooling air, and the one on the other side has been utilized to house eight 36-in. hydraulically operated gate valves, one of which is shown in Fig. 9, for controlling the high-pressure water going to the needle nozzles.

Being a municipal building and located on the Big Oak Flat road to Yosemite National Park, many visitors will stop to see the plant in operation. A gallery at one end of the generator room, reached by a special entrance, makes it possible for visitors to view the interior of the power house without being able to get on the floor and come in contact with the operators. A plan and cross-section of the power house is shown in Fig. 5.

Waterwheels and Generators

The tunnel and penstocks were so designed as to provide an effective head of 1,250 ft. on the nozzles of the waterwheels. This pressure is greater than has been used on the turbine type of waterwheel, necessitating the employment of the impulse type. Bids were invited for waterwheels having speeds of 225, 240 and 257 r.p.m., and for direct-connected generators of the same speeds. It was found that units having a speed of 257 r.p.m. would be cheaper and have equally as good efficiency as those operating more slowly. This speed was

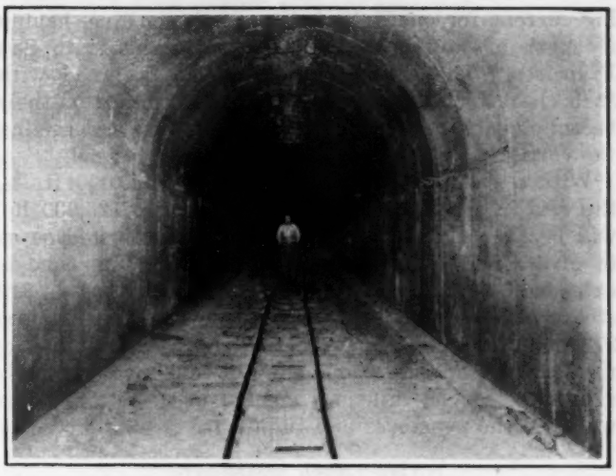


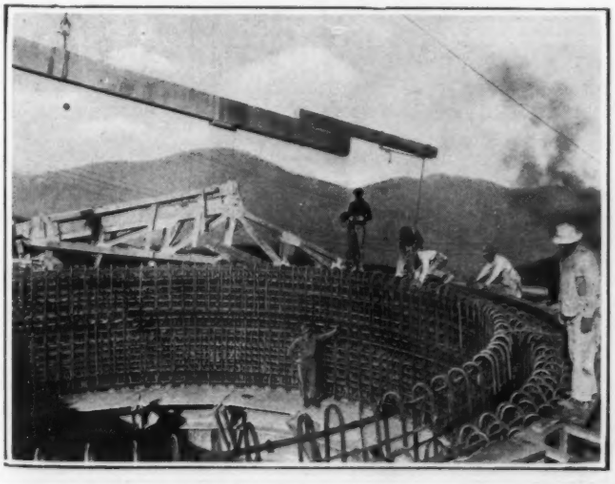
FIG. 6—VIEW IN THE CONCRETE-LINED SECTION OF THE 18-MILE TUNNEL

therefore selected, resulting in the purchase of twenty-eight pole generators.

Waterwheel contracts were awarded to the Pelton Water Wheel Company of San Francisco, which has supplied double overhung wheels having a total weight of 366,500 lb. each and a total full load rating of 25,000 hp., with a maximum rating of 27,500 hp. each. The contract for the generators was awarded to the General Electric Company. These have a weight of 253,000 lb. each and will deliver 20,000 kva. at 11,000 volts, three phase, sixty cycles.

Four of these complete units were purchased, making an initial installation of 100,000 hp., or 80,000 kva. Operated on 100 per cent load factor, three units would consume all of the 620 sec.-ft. of water that is available. The fourth unit permits operating at 75 per cent load factor, or it may be used as a spare unit should it be possible to operate at higher load factor. On account of the characteristics of the future plants to be installed higher up on the Tuolumne River, it will later be necessary to operate the Moccasin plant at a load factor of 50 per cent. This will require the installation of two additional units when the other plants are constructed, thus making an ultimate of six units at Moccasin. Provision has been made to install these two units without disturbing the four present machines.

The size of each machine is sufficient to supply charg-



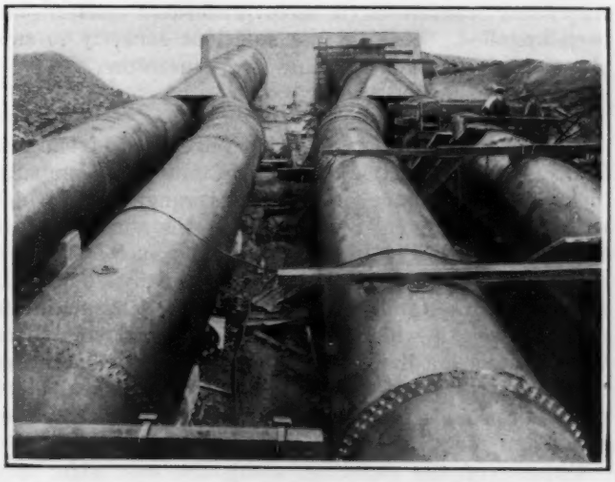


FIG. 7 (LEFT)—REINFORCING THE SURGE SHAFT. FIG. 8 (RIGHT)—WYES WHERE THE 98-IN. TRIPLE-RIVETED LAP-JOINED PIPE CHANGES TO TWO 66-IN. LONGITUDINAL SEAM HAMMER-FORGE-WELDED PIPES WITH "BUMPED" JOINTS

ing current for one unloaded transmission line, having a length of 140 miles from the power house to San Francisco. The generators have been designed with such characteristics as to obviate any chance of their becoming self-exciting under this condition and raising the voltage to a point greatly in excess of normal.

With a generator flywheel effect of 3,000,000 ft.-lb., the rise in speed for rejection of a load of 25,000 hp. will be 14½ per cent with the governor adjusted so as to give a full stroke in two seconds. If this time is extended so that the governor does not move a full stroke in less than three seconds, the speed rise will be 21½ per cent. Load may be taken on one unit at the rate of 2,000 hp. per second without causing appreciable drop in speed or injurious change in pressure of the water in the penstocks and tunnel.

WATERWHEEL GOVERNORS

Each of the two waterwheels forming a unit is fitted with a separate governor, actuated by oil under a pressure of 150 lb. This oil is supplied by a motor-driven oil-pumping set equipped with an accumulator, one being furnished for each unit. One of the four oil-pressure sets has a waterwheel as well as a motor, which will make it possible to start up the power house without having electrical power from an external source.

Several new features making for simplicity of operation have been embodied in the governor apparatus. By simply throwing one lever a waterwheel may be thrown over from automatic to manual control. Both the hand and automatic control use mechanism synchronized so that the throwover takes place without hunting action of the governor or any change in waterwheel speed. The operator has full control over the speed of a unit from the switchboard on the operator's balcony. A remote control on the switchboard actuates a small master valve, which will completely shut down any unit. In addition, a load-limiting device gives the operator switchboard control over the amount of load carried by any unit. Large enameled indicators permit the operator to observe the position of the needle nozzle from the switchboard room.

Each of the generating units has a direct-connected 140-kw., 250-volt exciter overhung beyond one of the waterwheels. Being direct connected to the main waterwheel units, the necessity for a separate waterwheel-driven exciter is obviated. In order to take care of emergency conditions a motor-generator exciter has been installed. This set has sufficient capacity to supply excitation current for any two generators.

SWITCHBOARD AND BUSES

Switchboard equipment was purchased from the Westinghouse Electric & Manufacturing Company, including a regulator of the broad range type, which will automatically cut resistance into the generator field circuits at such a rate as to keep the exciter voltage, under all conditions of operation, at a point sufficiently high to insure stability and at the same time maintain a field strength which will produce normal voltage on the transmission line under all conditions of operation.

The control boards are equipped with sufficient blank panels to provide for the ultimate capacity of the power house and for six high-voltage transmission lines.

Outside of the building, along the east side, is a structural steel bus support. Within this structure twelve 6,667-kva. transformers have been installed to

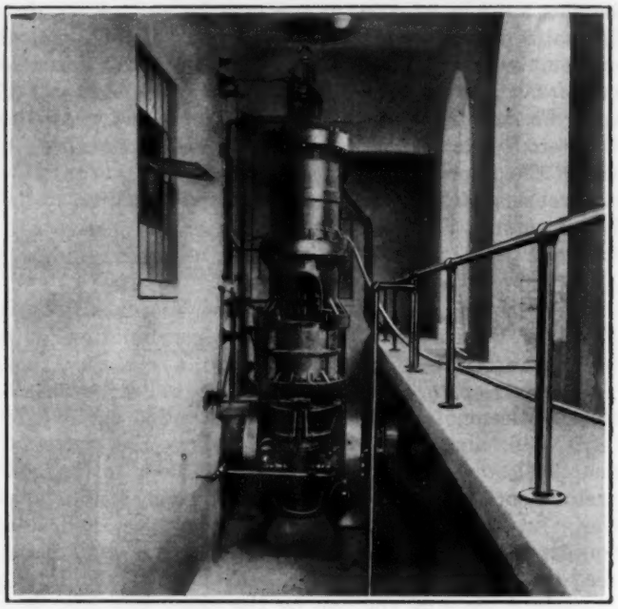


FIG. 9 — ONE OF THE EIGHT HYDRAULICALLY OPERATED GATE VALVES FOR CONTROLLING THE HIGH-PRESSURE WATER GOING TO THE NEEDLE NOZZLES

step the 11,000-volt current as generated up to either 115,000 or 154,000 volts for transmission to San Francisco. These transformers were furnished by the Westinghouse company and are of the water-cooled, oil-insulated type. One spare transformer is provided, which may be moved into the place of any transformer which becomes disabled. The high-voltage conductors

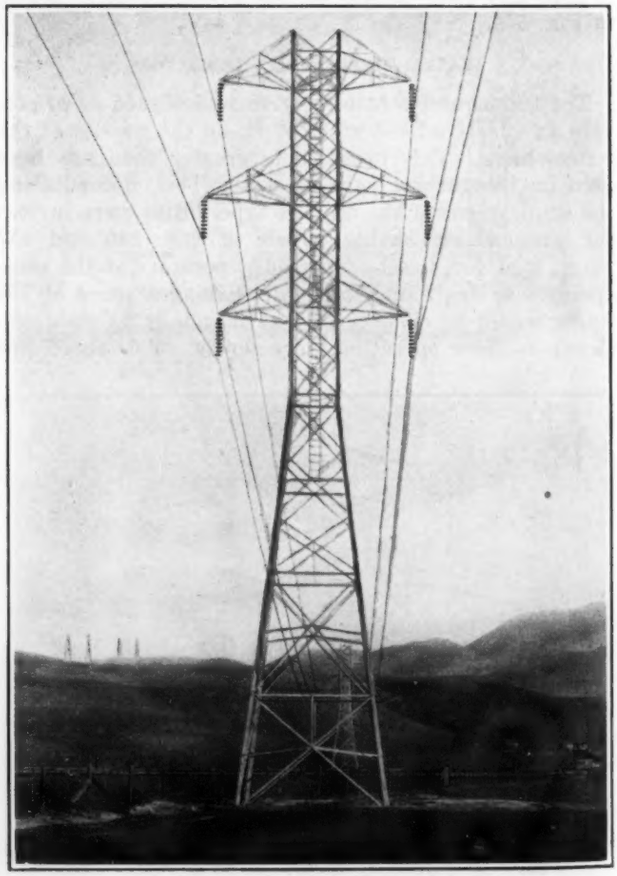


FIG. 10—STEEL TOWER TRANSMISSION LINE CARRYING TWO 154-KV. CIRCUITS

are of two types: Those of short length carrying the output of a generator unit are made of 2½-in. standard iron pipe, and extra heavy pipe of the same size is used for transmission line connections. The buses, running the length of the yard, are 750,000-circ.mil stranded copper cable.

The arrangement of the circuits is such that normally units will not be tied together except on the high-voltage side of the transformers. One 11-kv. bus running the length of the power house indoors has been provided. To this may be connected any generator and from it power may be taken for any transformer bank. To this bus also are connected the transformers supplying power used in the power house and around the camp. The switching arrangement out of doors has been so simplified as to employ the minimum number of high-voltage oil switches. A number of high-voltage disconnecting switches, operated by power from the switchboard, have been installed for establishing circuits, which are energized or de-energized through an oil circuit breaker. Interlocking arrangements between switches prevent the opening of the disconnect switches while carrying power.

TRANSMISSION LINE

Two transmission circuits on a single line of towers (see Fig. 10) have been built from the power house to the San Francisco Bay, a distance of 98.5 miles, involving 506 steel towers having a height of 98 ft. The line was designed and insulated for operation at 154 kv., but for the present will be operated at 115 kv. The lowest crossarm on these towers is 62 ft. above the ground. The three wires of a circuit are carried on one side of the towers and are spaced 15 ft. apart vertically. The distance between the two circuits measured transversely to the line is 24 ft. at top and bottom arms and 28 ft. at the middle arm.

The steel towers are made up of five types—viz., standard, for towers involving no special strength requirement; heavy duty towers for angles and points of heavy down pulls, and at steam railroad crossings; switch towers, which are modified heavy duty towers fitted with special arms to accommodate air break switches for use in sectionalizing the line. Provision is made for dividing each circuit into six sections for the isolation and location of trouble. In order to provide transpositions in the relative positions of the wires, the heavy duty tower has been modified so as to permit of revolving the conductors of each circuit in such a manner as to make a third of a barrel at each of the twelve transposition points.

The towers are made of galvanized steel and were supplied by the Pacific Coast Steel Company of San Francisco. The insulators used are of Westinghouse make, ten No. 601 units being used in a string on standard towers. Ten No. 631 units are used on heavy duty towers where dead-end connections are not made, while dead-end strings employ twelve No. 631 units.

The conductors are of 397,500 circ.mil steel reinforced aluminum for that portion of the line away from the Bay of San Francisco and were supplied by the Aluminum Company of America. For the portion of the line around the bay, where heavy salt fog is experienced, hemp-cored stranded copper cable furnished by the Anaconda Copper Mining Company was used. This conductor is composed of thirty wires having a total cross-sectional area of 345,000 circ.mil. The external diameter of the cable is 0.75 in.

This line goes almost directly east and west across the State of California and crosses some very rough country as well as some very level valley land. Spans of more than 2,000 ft. occur in the rough country, while in the valleys the spans average 950 ft. No very cold weather is experienced and the line has been strung so that with a temperature of 20 deg. F. and a wind producing a side pressure of 8 lb. per foot the stress in the conductors will not exceed 5,000 lb. This results in a tension of from 3,000 to 4,000 lb. in the line at average temperatures.

Communication between the power house and the receiving point will be provided by carrier current over the transmission wires. Inside the power house a loud-speaking telephone equipment for use between the switchboard room and the generating units has been furnished by the Western Electric Company.

DISPOSAL OF POWER

The city of San Francisco does not at the present time have a distribution system of its own and Hetch Hetchy power is being distributed for the city under an agency agreement with one of the privately operated central stations. This arrangement is a temporary expedient for the disposal of the power and will continue until such time as the people of San Francisco shall have decided what will ultimately be done with the output of the Hetch Hetchy hydro-electric plants.

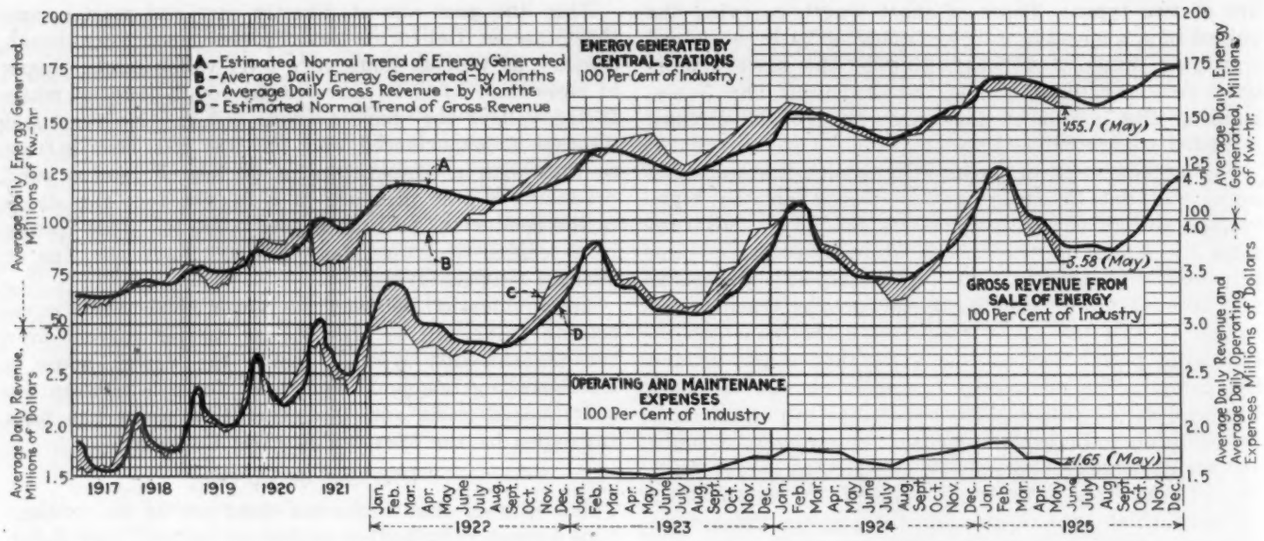
The writer wishes to give due credit to Nelson A. Eckart, principal assistant; Leslie W. Stocker, office engineer in charge of specifications; Paul J. Ost, chief electrical engineer, and R. P. McIntosh, chief designing engineer, for their assistance in the engineering work on the Hetch Hetchy project, the second largest project of its kind in the country.

National Electrical Code for 1925 Approved by A. E. S. C.

THE 1925 edition of the National Electrical Code, which is shortly to be published by the National Board of Fire Underwriters, will announce on its cover and title pages its approval as an American Standard by the American Engineering Standards Committee. The biennial revision of this bible of the electrical wiring industry was performed by the National Fire Protection Association as the sponsor organization through a sectional committee having thirty-nine organizations represented in its membership, including several federal, state and municipal bodies in addition to the various technical, industrial and commercial associations concerned.

Modern practice in the installation and use of electric wiring and apparatus within buildings for light, heat and power or for signaling, including radio, is in a large measure free of fire hazard to the premises and of the personal injury hazard to occupants. Improvement in the methods of accomplishing this safeguarding in the successive editions of the code has kept step with the improvements in the art of electricity. Therefore the code is said to have wider recognition and use by inspection authorities and others than any other set of technical regulations.

In its compilation and in its revision it has drawn upon nation-wide sources of experience and practice. Thereby it is provided that while invention is encouraged and economy is fostered, a suitable fact of safety is retained.


A – Estimated Normal Trend of Energy Generated
B – Average Daily Energy Generated – by Months
C – Average Daily Gross Revenue – by Months
D – Estimated Normal Trend of Gross Revenue
ENERGY GENERATED BY CENTRAL STATIONS
100 Per Cent of Industry
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
155.1 (May)
3.58 (May)
1.65 (May)
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue, Millions of Dollars
Average Daily Energy Generated, Millions of Kw.-hr.
Average Daily Revenue and Average Daily Operating Expenses Millions of Dollars
1917 1918 1919 1920 1921
1922 1923 1924 1925

Central Station Operations 8.9 per Cent Over Last Year

THE amount of energy generated by the electric light and power systems of the country totaled 4,808,333,000 kw.-hr. during May, or 8.9 per cent over May of last year. This increase is considerably above the increase reported for the first quarter of the year, 5.9 per cent. The May output was 4 per cent below the estimated normal for that month, this normal being based on the operations for the past five years.

The gross revenue during May totaled $110,900,000 and the operating expenses $51,250,000. A detailed discussion of the financial operations of the industry will be found in the Financial and Corporate Section.

The consumption of energy for industrial power purposes continues well above that of last year. Comparative consumption of central-station energy for power purposes by years, however, is not at all indicative of general business conditions, for the reason that during the twelve-month period a large number of new power customers are added to the central station lines.

TABLE I—GENERATION AND DISTRIBUTION OF CENTRAL-STATION ENERGY IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Kw.-Hr. Generated Monthly *			Distribution of Energy Generated										Energy Purchased by Public Utilities for Resale Kw.-Hr.	
				Total Energy Consumption by Central-Station Customers, Kw.-Hr.		Energy Consumed for Lighting, Kw.-Hr.		Energy Consumed for Power, Kw.-Hr.		Energy Sold to Electric Railways, Kw.-Hr.		Energy Used in Intracompany Business Including Line Losses, Kw.-Hr.			
	1925 Thousands	1924 Thousands	Per Cent Inc.	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands	1925 Thousands	1924 Thousands
March	4,963,857	4,595,960	8.1	4,008,857	3,707,960	1,123,000	1,075,000	2,349,857	2,108,960	536,000	524,000	958,000	888,000	768,000	704,000
April	4,778,036	4,350,412	10.1	3,855,036	3,510,412	1,067,000	1,022,000	2,279,036	2,005,412	509,000	483,000	923,000	840,000	768,000	682,500
May	4,808,333	4,416,150	8.9	3,880,633	3,564,650	1,077,000	1,032,000	2,263,633	2,000,650	540,000	532,000	927,700	851,500	763,000	676,000

* Data on "energy generated" are those collected and published by the United States Geological Survey for all public utilities minus such data as are collected on energy generated by electric railway companies, reclamation service and manufacturing plants. The data are, therefore, for the electric light and power industry only.

TABLE II—CENTRAL-STATION FINANCIAL OPERATIONS FOR THREE MONTHS IN THE UNITED STATES
(100 per Cent of the Industry)

Month	Gross Revenue from Sale of Energy†			Operating and Maintenance Expenses‡			Operating Ratio					
							Steam Plants		Hydro Plants		Combined Steam and Hydro Plants	
	1925 Thousands	1924 Thousands	Per Cent Increase	1925 Thousands	1924 Thousands	Per Cent Increase	1925	1924	1925	1924	1925	1924
March	119,000	112,300	5.9	52,400	51,100	2.7	43.0	46.0	30.0	28.0	39.0	42.0
April	117,000	108,400	7.8	52,200	48,300	7.8	44.0	49.2	29.0	29.0	40.5	46.8
May	110,900	101,700	9.0	51,250	47,760	7.3	44.8	50.0	27.5	28.0	41.2	47.3

† Aggregate gross revenue from actual consumers, and sales to other public utilities for resale, involving a certain amount of duplication.
‡ Do not include interest, taxes, depreciation or sinking fund.

TABLE III—OPERATIONS OF CENTRAL-STATION HYDRO AND FUEL POWER PLANTS IN THE UNITED STATES||
(100 per Cent of the Industry)

Month	Energy Generated						Fuel Consumption								
	Hydro Plants			Fuel Power Plants			Coal			Oil			Gas		
	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Inc.	1925 Thousands of Kw.-Hr.	1924 Thousands of Kw.-Hr.	Per Cent Inc.	1925 Short Tons	1924 Short Tons	Per Cent Inc.	1925 Barrels	1924 Barrels	Per Cent Inc.	1925 Barrels	1924 Barrels	Per Cent Inc.
March	2,009,222	1,705,060	17.4	2,954,635	2,890,000	2.4	2,754,265	2,781,084	—1.0	791,496	1,496,604	—46.2	3,214,656	3,099,404	3.9
April	1,988,628	1,814,599	9.6	2,789,408	2,525,813	10.4	2,587,970	2,479,826	4.4	658,231	1,167,841	—43.7	3,367,663	2,747,341	22.5
May	1,989,693	1,909,356	4.3	2,819,640	2,506,784	12.4	2,577,236	2,423,065	6.3	643,964	1,120,112	—42.5	3,439,064	2,894,262	18.8

|| As collected by United States Geological Survey. The data are for the electric light and power industry only.

Power Factor in Practice

Experience in the Pittsburgh District — Successful Results Obtained by Duquesne Light Company and West Penn Power Company—Details of Installations

By L. W. W. MORROW
Managing Editor of the ELECTRICAL WORLD

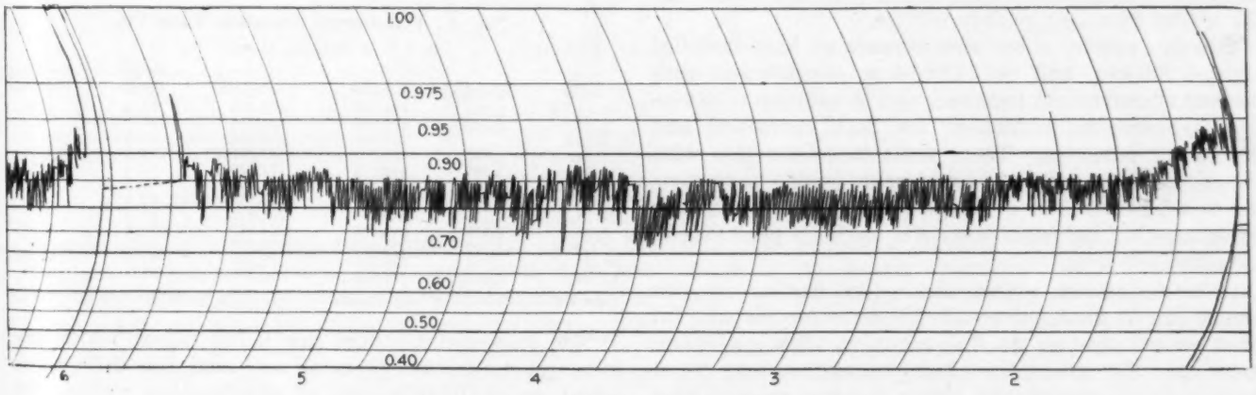
WESTERN Pennsylvania has many large industrial enterprises that are engaged in the production of coal, iron and steel, or in structural fabrication. Two of the chief electric utilities in this territory are the Duquesne Light Company, which supplies the Pittsburgh local territory, and the West Penn Power Company, which operates a large transmission system in the adjacent territory.

Since each of these utilities has a power factor rate and the industries in their territory are typical of those which could use corrective machinery to advantage, some experiences and opinions on power factor correction in this district should be of interest.

The best introduction to the experiences of the Duquesne Light Company is found in the remarks of M. E. Skinner, commercial manager, who stated: "We believe power factor correction is good business for both ourselves and our customers and have gone into the subject quite extensively. We have instituted corrective measures at our own expense by locating synchronous condensers at appropriately located substations and have a number of 3,750-kva. and 7,500-kva. units in operation. This plan has been followed since 1916 and at present there are 45,000 corrective kva. of this character installed. About two years ago it was decided to institute a power factor clause in our wholesale rate schedules which would be available to customers on an optional basis. This clause provides a penalty in the bill if the power factor is below 75 per cent and a bonus between this value and unity. The power factor of 75 per cent was the average power factor of the power customers and it was thought the power revenue would not be affected, since it was estimated the penalties and the bonuses would equalize each other. In its practical application this clause was instituted by installing reactive kva.-hr. and kw.-hr. meters, and then using the ratio of these readings to determine the amount of discount or penalty to apply to the customer's bill. The maximum discount amounted to about 8.8 per cent of the power bill if the customer made correction to unity power factor.

"A clause based upon the continuous record of meters was chosen, because a very large percentage of our load is taken by large users where monthly bills run into large figures and where changing conditions render any method based upon periodic tests open to question. Meters are ratcheted for lagging power factor only, thus preventing abuse by carrying heavy leading power factor with light loads.

"This clause is being put into effect gradually, because it was felt desirable to find out by field experiences its full possibility for securing correction. After trials over a period of time we found the clause would secure power factor correction if applied to large power customers, as they could afford to invest in the necessary metering equipment and usually had an engineering staff competent to maintain the full operating value of the corrective installation. Many of our customers, without making any additional investments, tuned their existing machines to secure the benefit of the discounts on their power bills and a number bought corrective equipment to a degree warranted by the inducement afforded by the available discounts. Very few cases were encountered in which the customer did not readily undertake to secure the bonus and no difficulty was found in instituting correction from engineering or public relations aspects. The customers selected for the first installations were all large consumers who could earn a bonus readily and we made no attempt to give penalties or bonuses to power customers generally. As a result we have paid larger sums for bonuses than we have taken in from penalties. These numerous semi-experimental installations, however, have convinced us it is advisable and feasible to institute the complete clause generally and sufficient data are available to show how this can be done as a part of our



A GOOD POWER FACTOR CHART OF A STEEL MILL

normal business. As a result of the work done our system now has a better power factor (72.8 per cent in 1922, 73.6 per cent in 1923, 74.7 per cent in 1924, without our own corrective equipment), and there have resulted other incidental good influences upon system operations. Correction undoubtedly has a bearing on the fact that during 1924 over 86 per cent of the energy generated was sold to customers. I do not think our method for securing correction can be instituted very successfully or economically for small power customers or for those with combined light and power loads. However, it is very successful for large power users and we believe it can be applied generally to this type of customer. Later it may be advisable to raise the power factor value which will earn a bonus to more than 75 per cent."

An interview with F. D. Mahoney, commercial manager of the West Penn Power Company, proved very interesting and serves to illustrate the fact that power factor correction is not hedged about by methods, but is a matter of business judgment and the application of one of many methods. Mr. Mahoney stated his experience and opinions as follows:

"Power factor correction has long been in successful operation on the West Penn system, and as a result of our experience with the methods used we have become convinced it is easy to institute and simple to operate. We know it is very beneficial to ourselves and to our customers, for it results in better and cheaper service to customers and makes it more economical and simple for the utility to supply quality service.

"On this system at our own expense we have installed eight 5,000-kva. and two 2,000-kva. synchronous condensers at convenient locations, and in addition a 30,000-kva. synchronous condenser for both corrective and regulatory purposes. These units in conjunction with the correction instituted by customers enable us to operate at a power factor of about 89 per cent on a system covering a big industrial area and having a peak load of over 160,000 kw.

"I doubt if one precise corrective method or rate clause can be used universally to secure correction, for even on our system we find many variable conditions existing. For example, voltage regulation may be so intimately associated with power factor correction that it cannot be treated separately. Our general plan, therefore, is to secure correction wherever possible and to use a minimum of complexity in metering, billing and rate making. Our main object is to give good service at a reasonable profit and to have satisfied customers, and any corrective scheme must aid this plan.

TABLE II—TYPICAL CUSTOMERS' RECORD

No. 1. Columbia Steel Shafting Co., Rankin Plant

Clara St., Rankin, Pa.

Reactive meters installed May 21, 1924

Date	Demand	Kw.-Hr.	R-Kw.-Hr.	Ratio R-Kw.-Hr. Kw.-Hr.	Power Factor	Per Cent Discount
5–22	151	1,250	1,400	1.1200	66.[illegible]	—2.38
6–21	123	22,800	35,300	1.5482	54.3	—6.66
7–23	133	22,050	17,800	0.8073	77.8	0.744
8–21	123	17,700	10,400	0.5876	86.2	2.93
9–22	165	30,800	11,300	0.3669	93.9	5.16
10–22	151	28,250	12,900	0.4565	91.0	4.26

No. 2. National Tube Co., Christy Park Works

Penny St. & B. & O. R. R., McKeesport, Pa.

Date	Demand	Kw.-Hr.	R-Kw.-Hr	Power Factor	Per Cent Discount
2–29	2,019	.....	.....	....	....
3–31	1,822	276,500	366,000	60.3	—4.4
4–28	2,044	610,000	748,000	63.2	—3.4
5–31	1,911	640,500	888,000	58.5	—5.05
6–30	1,933	493,000	586,000	64.4	—3.06
7–31	1,822	492,500	368,000	80.1	1.35
8–30	2,222	586,000	457,000	78.9	1.02
9–30	2,000	551,000	343,000	78.6	0.94
10–30	1,711	466,500	406,000	75.4	0.12

No. 3. Pittsburgh Screw & Bolt Co.

Preble Ave., N. S., Pittsburgh, Pa.

Date	Demand	Kw.-Hr.	R-Kw.-Hr.	Power Factor	Per Cent Discount
12–19	1,464	80,950	53,880	83.2	2.16
1–18–24	1,469	200,700	130,680	83.8	2.31
2–18	1,541	260,450	170,160	83.8	2.32
3–18	1,579	273,800	174,000	84.4	2.47
4–17	1,563	251,450	146,280	86.4	3.00
5–17	1,493	212,200	101,280	90.2	4.05
6–19	1,440	194,500	71,100	93.9	5.16
7–19	1,373	145,250	52,680	94.0	5.19
8–	1,269	130,700	69,840	88.2	3.48
9–19	1,523	209,250	88,320	92.1	4.60
10–18	1,523	208,800	101,160	90.0	3.97
11–19	1,579	195,200	90,360	90.7	4.19

No. 4. Pittsburgh Seamless Tube Co.

P. R.R. & 46th St., Morado, Pa.

Date	Demand	Kw.-Hr.	R-Kw.-Hr.	Power Factor	Per Cent Discount
1–24–24	2,300	768,500	555,000	81.1	1.60
2–25	2,300	508,500	184,000	94.0	5.20
3–13	....	280,000	93,000	94.9	5.50
3–24	2,350	165,500	57,000	94.5	5.38
4–24	2,400	510,500	172,000	94.8	5.45
5–24	2,400	624,500	222,000	94.2	5.26
6–24	2,300	542,000	201,000	93.8	5.11
7–24	2,125	561,000	206,000	93.9	5.15
8–24	2,200	690,500	271,000	93.1	4.89
9–24	2,300	566,000	195,000	94.5	5.37
10–24	2,450	530,500	209,000	93.0	4.88
11–24	2,325	470,500	166,000	94.3	5.29

"On this system there are many mines which use synchronous motor-generator sets, and also there are a great many installations of synchronous motors for driving pumps and fans. We give an inducement to customers to use synchronous motors wherever practicable. In this connection the motor manufacturers should strive to replace the existing design of low power factor induction motors with equally good high power factor motors. The Wagner Electric Company,

TABLE I—MONTHLY TABULATION OF THE RESULTS OF POWER FACTOR CORRECTION FOR SE

Customer	February Kw.-Hr.	February P. F.	March Kw.-Hr.	March P. F.	April Kw.-Hr.	April P. F.	May Kw.-Hr.	May P. F.	June Kw.-Hr.	June P. F.	July Kw.-Hr.	July P. F.	Aug Kw.-Hr.
American Steel Foundries	79,250	99.8	85,100	99.6	95,950	99.2	100,350	99.5	96,750	99.7	101,350	99.8	91,350
Crucible Steel Co.	924,500	85.1	940,000	83.9	870,000	83.8	643,000	83.2	258,000	77.2	187,000	79.8	80,000
Dilworth Porter Co.	184,000	95.3	169,600	95.5	172,800	94.4	160,000	94.4	140,800	94.9	116,800	92.7	88,000
Flannery Bolt Co.	42,600	70.9	66,300	84.9	81,050	89.9	62,300	86.2	36,350	77.0	32,300	74.3	50,650
National Tube Co. No. 1	454,000	100.0	503,000	100.0	490,000	100.0	470,000	100.0	420,000	100.0	722,000	100.0	378,000
National Tube Co. No. 2	.....	.....	56,500	100.0	71,650	100.0	88,750	100.0	97,800	100.0	74,100	100.0	114,900
Pgh. Screw & Bolt Co.	260,500	83.8	273,800	84.0	251,450	86.4	212,200	90.3	194,500	93.9	145,200	94.1	130,700
Pgh. Seamless Tube Co.	508,500	94.0	445,500	94.8	510,500	94.8	624,500	94.2	542,000	93.7	561,000	95.3	690,500
Riter-Conley Co.	333,200	99.3	330,600	96.5	331,200	97.1	258,600	95.4	262,800	97.2	223,800	97.5	182,400
Superior Steel Corp.	984,000	98.1	916,000	99.6	752,000	100.0	596,000	99.9	480,000	99.5	240,000	99.6	544,000
Standard Gauge Steel Co.	56,700	99.1	115,250	99.7	109,700	99.2	79,750	99.9	81,650	99.1	67,050	98.9	67,650
Union Electric Steel Co.	237,000	84.5	298,300	88.7	239,150	87.9	239,150	90.5	225,650	90.2	254,650	88.7	230,000
Vanadium Corp. of A. No. 1	2,608,000	94.6	2,829,500	94.6	2,602,500	95.2	2,887,000	95.4	2,623,000	95.2	2,871,500	95.4	2,930,500
Vanadium Corp. of A. No. 2	461,500	99.7	511,000	99.6	501,500	99.7	508,000	99.8	496,500	99.8	500,500	99.5	498,500
Columbia Steel Shafting Co.	30,350	75.1	81,600	75.1	93,600	78.2	97,650	81.2	74,600	91.0	51,300	93.3	47,750
Witherow Steel Co.	.....	.....	.....	.....	67,650	88.5	142,000	92.8	84,700	97.0	77,100	88.6	68,000
National Tube No. 3	.....	.....	.....	.....	276,500	60.3	610,000	63.2	640,500	58.5	493,000	64.4	492,500
Universal Steel Co.	181,000	86.9	940,500	86.6	486,000	85.4	476,500	85.6	327,000	85.9	.....	....	.....
Average P. F.	.....	91.1	.....	92.7	.....	91.1	.....	91.75	.....	91.66	.....	91.3	.....

Total customers Dec. 31, 1924, 205,463. Total output 1924, 1,078,172,730.
These eighteen customers represent slightly less than 10 per cent of the output of the system.

in my opinion, deserves great credit for bringing out a high power factor industrial motor.

"Our rate for power customers provides for billing on a kilovolt-ampere demand basis and provides a bonus for a power factor of unity or better. The usual metering installation consists of a kilowatt-hour meter, a kilowatt demand meter and a graphic power factor meter. The power factor meter is used only intermittently and is simply a convenient check on the data obtained when power contracts are first signed. With this system we have little trouble and it operates with the greatest simplicity. We are convinced power factor correction is good business for ourselves and for our customers and will continue to push it."

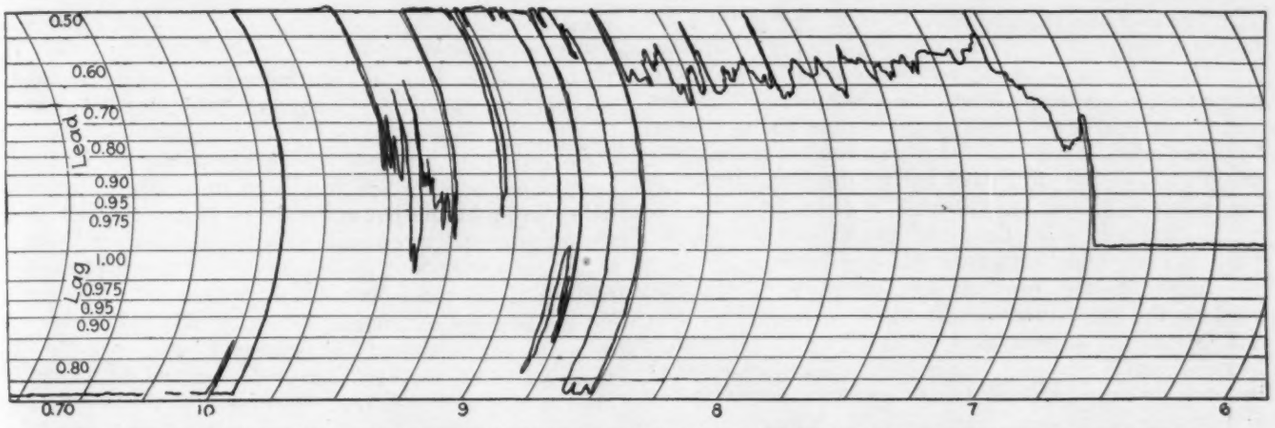
Actual data on the results of correction on the Duquesne Light system were made available by Joseph McKinley, the manager of power sales for that company. He stated that it was difficult to measure improvements quantitatively on such a large system, but that a general improvement was undoubtedly had in service quality and system regulation, as will be seen by a study of Tables I and II. In nearly every case the customer attempted to obtain a greater discount on his power bill and a better operating power factor, after his attention was directed to these possibilities.

Visits were made to several installations of the Duquesne Light Company and customers were interviewed and installations inspected. In no case was hostility to power factor correction encountered, and in many cases power factor correction was comparable to a crossword puzzle in the interest it aroused in the industrial executives and engineers.

An interesting experience with correction was had by the Witherow Steel Company. The superintendent of the plant, P. L. Coyle, stated: "I know nothing about power factor and have simply followed the advice of utility representatives, but so far as I can see correction is a good thing. We invested a little money to secure it, but are getting a discount of over a hundred dollars a month on our power bill. Correction has not disturbed our operations; on the contrary, Mr. Janessa says they have been improved."

An inspection of the works showed about 175 induction motors in operation, all of the squirrel-cage type except two. In addition there was in operation a motor-generator set to supply direct current to the cranes, with the synchronous motor of this set rated 570 amp., 440 volts, three phase, sixty cycles. A 1,500-kva., 900-r.p.m., 440-volt synchronous condenser was also operated to improve regulation and to aid in power factor correction. The demand on the plant was about 1,000 kw. and the power factor before correction was about 70 per cent. By using the motor-generator set and the synchronous condenser for correction the power factor was increased to about 90 per cent.

A curve-drawing power factor meter was placed on the synchronous condenser and a practice was made of operating this unit with 30 per cent leading power factor. Voltage regulation requirements in the rolling mill and variations in load conditions often made it necessary to depart from this value, however. An extreme and rather interesting chart taken from the power factor meter is shown herewith.



AN EXTREME VARIATION IN POWER FACTOR IN A STEEL PLANT USING AN UNATTENDED SYNCHRONOUS CONDENSER

Correction at this point was adopted chiefly because the representative of the Duquesne Light Company told the plant superintendent that he possessed equipment in his plant which, if operated correctly, would reduce his power bill. The engineer of the plant, A. Janessa, was very much interested in correction and reported that its institution made little if any more work for him, as only an occasional inspection was required of conditions at the motor-generator set, which usually operated at 50 per cent leading power factor, and at the synchronous condenser, which usually operated at 30 per cent leading power factor.

An installation of this character, however, would obtain better corrective results if an automatic means for controlling power factor conditions could be introduced. The heavy and intermittent loads and the changing production requirements affect power factor and regulation in such a way that correction is best if an automatic device is used to control machines, or if the corrective equipment is all located at one spot and an attendant is always present.

A very intelligently engineered correction installation was found at the plant of the Pittsburgh Bolt & Screw Company. J. H. Reniers, the electrical engineer, when his company was notified that a power factor clause would be applied to it, made an engineering and eco-

QUESNE LIGHT COMPANY CUSTOMERS

— August — Kw.-Hr.	— September — Kw.-Hr.	P. F.	— October — Kw.-Hr.	P. F.	— November — Kw.-Hr.	P. F.
91,350	86,750	99.8	100,300	99.9	107,150	99.1
88,000	504,000	77.0	214,000	79.7	800,000	84.0
50,650	84,000	97.2	80,800	98.0	118,400	94.2
378,000	112,400	90.2	59,800	93.2	54,850	94.9
114,900	252,000	100.0	174,000	100.0	258,000	100.0
130,700	78,998	100.0	49,600	100.0	16,850	100.0
690,500	199,250	92.1	208,800	90.0	195,200	90.8
182,400	504,000	94.6	530,500	93.0	470,500	94.3
544,000	211,800	99.6	202,200	99.8	199,800	99.8
67,650	504,000	100.0	576,000	99.9	720,000	99.4
230,000	77,350	99.2	92,900	99.4	80,750	97.6
2,930,500	118,050	86.9	167,550	87.9	175,000	90.0
498,500	504,000	95.5	2,947,000	94.4	2,776,000	93.2
47,750	497,000	99.8	455,650	99.1	470,700	97.5
68,000	52,750	96.5	66,700	99.8	73,800	99.9
492,500	74,900	87.4	94,250	88.5	123,000	71.0
.....	504,000	78.9	551,000	78.6	466,500	75.4
.....	504,000	85.9	473,000	85.9	434,500	86.5
	.....	93.4	.....	93.7	.....	92.6

nomic study of the plant and removed some group drive installations. These consisted of one 75-hp., two 40-hp. and two 30-hp. motor installations, and sixty-five motors averaging about 3 hp. each were substituted for them. This move, in combination with some rearrangements of circuits, increased the plant power factor at the switchboard from about 60 per cent to about 75 per cent.

Following these studies correction was instituted by locating two motor-generator sets at the extreme ends of load circuits. Since these sets supplied direct-current crane service, there was ample opportunity to use the synchronous motors of the sets for corrective purposes and the greatest advantages of the sets were obtained by securing voltage regulation, by reducing internal plant losses and by correcting power factor at the loads. As a result of correction this company has received an average discount of 4½ per cent on power bills ranging from $4,000 to $4,500 per month for a period of ten months. Mr. Reniers stated: "After this plant operates at full capacity we should be able to get a discount of 5 per cent on our power bills and at the same time reduce the losses in our corrective equipment. Our total investment in corrective apparatus is about $18,000 and it is a simple matter to determine a balance between the cost of correction and the financial inducements offered for correction. We use two synchronous motor-generator sets at the load ends of the lines and obtain a power factor at our switchboard of from 90 to 95 per cent. Also we get a voltage of 440 to 445 now at our machines, whereas heretofore this was about 438. This has meant better production; for example, on one machine the speed increased from 54 r.p.m. to 57 r.p.m. and this meant an increased production of 1,440 manufactured units per eight-hour day. Thus the indirect benefits we have received from correcting power factor and improving voltage regulation in themselves offset our financial investment. Correction offers no operating difficulties and we are well satisfied with the results we have obtained."

This plant has a load of about 3,000 kw. in induction motors and through correction maintains a power factor of about 95 per cent. A typical set of readings on one of the motor-generator sets is given in Table IV as well as the total power used per month.

Knowing the average cost of power per kilowatt-hour, the total set losses, the total power and the discounts on the power bills, it is a simple calculation to determine the degree to which correction can be carried profitably in the plant. Thus the use of meters on the corrective equipment gives data for accurate economic analyses.

The Pittsburgh-Des Moines Steel Company desired to change its contracts for power and noted the optional clause giving discounts for power factor correction. Since the company had corrective equipment in the form of synchronous motor-generator sets available, Manager C. E. Wolfstyn decided it would be profitable to try correction. An added favorable feature was that the corrective equipment was located at one spot, where switchboard attendance was possible by the engineer in charge.

This plant had a demand of about 425 kw. with about 700 hp. in motors connected and was metered at 2,200 volts. The normal power factor was 70 to 71 per cent. After reactive component meters were installed and corrective efforts made, the power factor was increased to 90.1 per cent and a discount of about 4 per cent was obtained on a power bill of about $1,500 per month.

TABLE III—AN ANALYSIS OF A CUSTOMER BASED ON RATES OF WEST PENN SYSTEM

	80 Per Cent Power Factor	Leading Power Factor
Motor cost (11,550 hp.) complete	$330,000	$330,000
Condenser cost (5,000 kva.)	.....	30,000
Total cost of equipment	$330,000	$360,000
Fixed charges at 12 per cent	39,600	43,200
Power Costs		
Average demand, hp.	8,500	8,500
Average demand, kva. (80% P. F.)	7,926	.....
Average demand, kw. (unity P. F.)	.....	6,491
Consumption, kw.-hr.	2,789,270	2,859,002
Credits for transformer ownership (10%), kw.-hr.	278,927	285,902
Credits for P. F. correction (5%), kw.-hr.	.....	142,951
Net consumption, kw.-hr.	2,510,343	2,430,167
Primary block (70 hours use of demand), kw.-hr.	554,820	454,370
Secondary block (115 hours use of demand), kw.-hr.	911,490	746,465
Tertiary block (115 hours use of demand), kw.-hr.	911,490	746,465
Excess, kw.-hr.	132,543	482,867
Gross charge per month	$52,017.70	$45,407.31
Block discount	$21,968.61	$19,126.14
	$30,049.09	$26,281.17
Prompt payment discount, 2 per cent	$600.98	$525.62
Net charge per month	$29,448.11	$25,755.55
Annual power charges	$353,377.32	$309,066.60
Annual fixed charges	$39,600.00	$43,200.00
Total cost per year	$392,977.32	$352,266.60
Annual saving for P.F. correction	.....	$40,710.72

This correction was obtained by merely tuning up existing equipment and by watching field rheostats more closely. At first a 50-kw. synchronous motor set was used and this increased the power factor to 82.7 per cent; later another set was used to secure correction, which brought the power factor to 90.1 per cent. Correction was instituted readily, with no additions to operating personnel, and the results have been very satisfactory to the management.

The Dravo Contracting Company decided to earn a discount on its power bill because it was operating at from 60 to 65 per cent power factor and happened to need a new motor-driven compressor. By securing a compressor with a 450-hp. synchronous motor-generator and by using a crane set already available the engineers of the plant were able to obtain a power factor of about 89 to 90 per cent and a discount on the power bill of about 4 per cent on an average bill of $2,300 per month. The crane set is located at the extreme end of the plant service and improves voltage regulation and the 450-hp. compressor is at the load center. As stated by R. V. Coolidge: "We became interested in correction because of the financial inducements offered us and installed meters and operated our equipment to secure the economic benefits of correction. This procedure has paid us in direct and indirect returns and has made us study our whole plant installation more closely. Operating complications are not encountered and we are well satisfied. We did not have to invest in corrective equipment, but even so we would not hesitate to do so if we could amortize the cost in two or three years."

A very severe service condition was encountered in supplying the Pittsburgh Seamless Tube Company. The plant was at the end of a long line involving thirty-two

TABLE IV—USE OF MOTOR-GENERATOR SET FOR CORRECTION

Date 1924	Synchronous Motor Input Kw.-Hr.	D. C. Generator Output Kw.-Hr.	M-G Set Losses	Total Plant Kw.-Hr.	Plant Load P. F.
Sept.	14,100	5,713	8,387	270,000	92.1
Oct.	13,800	5,706	8,094	250,000	90.0
Nov.	9,400	4,082	5,318	206,000	90.7
Dec.	14,000	8,299	5,701	351,660	96.4
Jan.	15,500	7,084	8,416	313,500	96.8
Feb.	14,800	7,260	7,540	275,500	97.4
March	17,200	8,224	8,976	293,800	97.7
April	14,900	6,260	8,640	263,300	98.5

miles of 66-kv. circuit and eight miles of 22-kv. circuit. The inherent power factor of the installation of mill motors was only 35 to 45 per cent and voltage regulation requirements were very severe. A solution was found in the purchase and installation of a synchronous condenser. This increased the power factor from about 40 per cent to 93 per cent and through improved regulaton and power factor correction enabled better service to be rendered this customer.

CONCLUSIONS

1. Power factor correction can be instituted successfully in the steel, glass and coal industries by the application of some type of power factor clause that gives a financial inducement to customers.

2. A growing utility can maintain power factor conditions successfully by correcting the larger power loads in sufficient degree to give a good system power factor. The cost of doing this and the means employed depend upon the situation on individual properties, but the final result is more or less equivalent to substation correction of power factor and voltage.

3. Many factories possess equipment that can be operated to secure power factor correction provided financial inducements are offered. Industrial users will not make investments in corrective equipment unless the money expended can be recouped in less than five years.

4. Factories having heavy and intermittent loads are corrected best by having a switchboard attendant. An automatic power factor and voltage control device would be very useful for many applications of synchronous corrective equipment.

5. On large systems with widely separated and fluctuating heavy loads it becomes very difficult to separate power factor correction from voltage regulation and the effects of these two factors on industrial production. Any analysis of correction results on systems of this type should be studied with this fact in mind and the results should be weighed as to the possibilities of securing (a) better voltage regulation by other means and (b) substation correction for each load territory.

6. The use of synchronous motors and synchronous condensers for corrective purposes can be secured on customer properties provided inducements are offered and the precise form of rate or method of instituting correction has little influence on the results.

Developed Water Power of the World

At the End of 1923 It Amounted to 29,000,000 Hp., According to the Estimate of the United States Geological Survey

THE developed water power of the world in 1920 was about 23,000,000 hp., according to an estimate made by the United States Department of the Interior in 1921 through the Geological Survey. At the end of 1923, according to the best information available, it was about 29,000,000 hp., an increase of 26 per cent in about three years. The increase was about 1,500,000 hp. in North America, 3,400,000 hp. in Europe and 1,000,000 hp. in Asia. Europe as a whole has passed

SUMMARY OF POTENTIAL AND DEVELOPED WATER POWER IN 1923

North and Central America	Developed, Hp.	Potential, Hp.
Mexico	300,000	6,000,000
United States	10,000,000	35,000,000
Alaska	40,000	1,000,000
Newfoundland	60,000	400,000
Canada	3,227,000	18,250,000
Costa Rica	15,000	1,000,000
Guatemala	4,000	1,500,000
Honduras	3,000	1,000,000
Nicaragua	400	800,000
Salvador	2,700	200,000
Panama	13,300	500,000
West Indies	19,350	150,000
South America		
Approximate total	13,700,000	66,000,000
Argentina	25,000	5,000,000
Bolivia	12,000	2,500,000
Brazil	450,000	25,000,000
British Guiana	.....	2,500,000
Dutch Guiana	.....	800,000
French Guiana	.....	500,000
Chile	90,000	2,500,000
Colombia	25,000	4,000,000
Ecuador	5,500	1,000,000
Paraguay	200	2,000,000
Peru	35,000	4,500,000
Uraguay	.....	300,000
Venezuela	12,500	3,000,000
Europe		
Approximate total	675,000	54,000,000
Sweden	1,416,000	8,000,000
Norway	1,820,000	9,500,000
Finland	220,000	1,800,000
Russia	150,000	3,000,000
Esthonia	16,950	125,000
Latvia and Lithuania	5,000	100,000
Poland	85,000	1,400,000
Ukraine	40,000	425,000
Region of the Caucasus	5,000	5,000,000
Hungary	3,000	175,000
Czechoslovakia	155,000	1,000,000
Jugoslavia	166,000	2,200,000
Austria	439,000	1,660,000
Rumania	30,000	1,100,000
Bulgaria	8,000	1,200,000
Greece	8,000	250,000
Turkey	.....	Small

Europe—Continued	Developed, Hp.	Potential, Hp.
Albania	1,000	500,000
Italy	1,800,000	3,800,000
Switzerland	1,490,000	2,500,000
Germany	1,100,000	2,000,000
France	2,100,000	5,400,000
British Isles	250,000	850,000
Belgium	700	Small
Denmark	1,500	9,000
Netherlands	150	Small
Spain	1,000,000	4,000,000
Portugal	10,000	300,000
Iceland	.....	500,000
Approximate total	12,300,000	57,000,000
Asia		
Chinese Republic	1,650	20,000,000
India	197,000	27,000,000
Asia Minor	500	500,000
Arabia	.....	.....
Persia	.....	200,000
Afghanistan	2,000	500,000
Siberia	90,800	8,000,000
French Indo-China	.....	4,000,000
Siam and Malay States	4,500	4,000,000
Chosen	18,300	500,000
Japan	1,694,000	4,500,000
Approximate total	2,000,000	69,000,000
Africa		
Tangier	.....	50,000
Morocco	.....	250,000
Algeria	130	200,000
Tunis	.....	30,000
Tripoli	.....	Small
Eritrea	.....	Small
British Somali	.....	Small
Italian Somali	.....	Small
Gold Coast and British mandate in Togo	.....	1,450,000
Liberia	.....	4,000,000
Sierra Leone	.....	1,700,000
Senegal	.....	250,000
Rio de Oro	.....	Small
Gambia	.....	Small
Portuguese Guinea	.....	Small
Union of South Africa	5,000	1,600,000
Angola	4,000	4,000,000

Africa—Continued	Developed, Hp.	Potential, Hp.
Southwest Africa (Union of South Africa mandate)	.....	150,000
Belgian Congo and Belgian mandate	250	90,000,000
French Congo	.....	35,000,000
French mandate in Cameroon	.....	13,000,000
Nigeria and British mandate in Cameroon	.....	9,000,000
Rhodesia	2,500	2,500,000
Tanganyika (British mandate)	800	2,700,000
British Central Africa	.....	1,200,000
British East Africa	900	4,700,000
Portuguese East Africa	.....	3,700,000
Bechuanaland	.....	20,000
Abyssinia	.....	4,000,000
Egypt	.....	600,000
Ivory Coast, Dahomey and French mandate in Togo	.....	2,850,000
French Guinea	.....	2,000,000
French Sudan	.....	1,000,000
Madagascar	100	5,000,000
Approximate total	14,000	190,000,000
Oceanica		
Australia	200	600,000
New Zealand	45,000	2,500,000
Philippine Islands	.....	1,500,000
Sumatra	2,000	2,000,000
Java	60,000	750,000
Borneo, including New Guinea and Papua	.....	7,500,000
Tasmania	70,000	700,000
Celebes	500	1,000,000
Hawaii	25,000	100,000
Approximate total	220,000	17,000,000
Recapitulation		
North America	13,700,000	66,000,000
South America	675,000	54,000,000
Europe	12,300,000	57,000,000
Asia	2,000,000	69,000,000
Africa	14,000	190,000,000
Oceanica	220,000	17,000,000
Approximate total	29,000,000	453,000,000

the United States in the rate of development of water power, which has been forced on all the industrial countries except Great Britain by the high price of coal. The increase in the production of electricity by water power in the United States for the same three years was about 20 per cent. The development of water power in the United States, although it is now going forward more rapidly than ever before, shows a percentage of increase less than that in other countries.

The estimate of the developed water power in the United States includes 9,087,000 hp. in plants of 100-hp. capacity or more, an estimate based on excellent data, and 900,000 hp. in plants of less than 100 hp. capacity, a very rough estimate based on the census of 1908.

In the accompanying table the figures showing the potential power for the United States represent the power available 90 per cent of the time at 70 per cent efficiency.

Dielectric Losses in Cables

The Decreased Efficiency of High-Tension Transmission Cables Due to Dielectric Loss Discussed—Losses on Yearly Basis Evaluated—Experiments and Tests Employed

By FRANK A. BROWNELL
Street Department, Public Service Production Company, Newark, N. J.

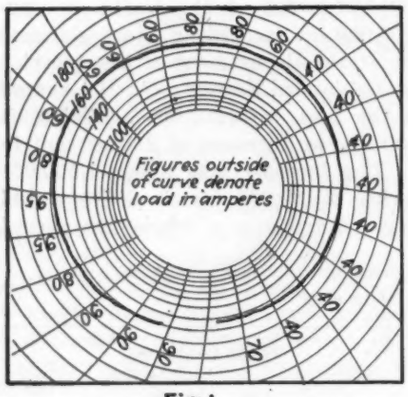


FIG. 1—SHEATH TEMPERATURE OF HOT SPOT IN THE OLD CABLE

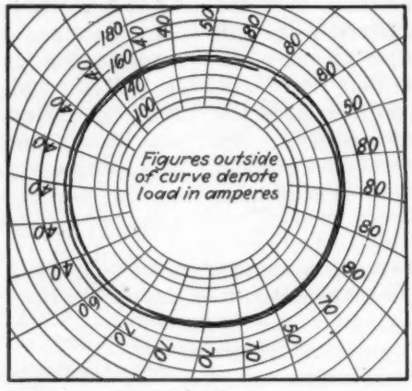


FIG. 2—SHEATH TEMPERATURE OF OLD CABLE WITH AND WITHOUT LOAD

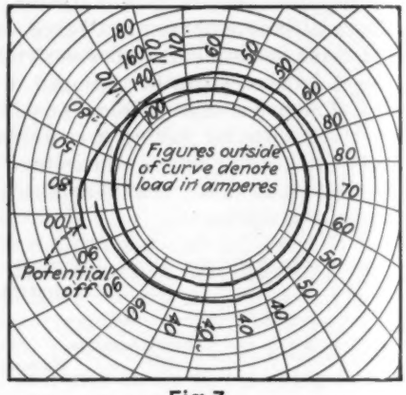


FIG. 3—SHEATH TEMPERATURE WITH ARTIFICIAL COOLING

VERY little information is available on the actual loss in money due to energy dissipation in the dielectric and the decreased carrying capacity of transmission cables in service because of this loss. Dielectric loss is known as dielectric hysteresis. There is assumed to be some molecular action in the dielectric similar to that of iron in a transformer, although this has not been thoroughly proved. Some other theories have been advanced and cable authorities in general do not agree as to the exact cause of this loss.

In the case of a perfect dielectric, the charging current would be a true capacity current exactly 90 deg. in advance of the impressed electromotive force. The cosine of this angle is zero, so there would be no loss. However, cables do not have a perfect dielectric and consequently the charging current does not lead the voltage by 90 deg., but by some angle less than this, depending upon the quality of the insulation. The cosine of this angle is called the power factor of the dielectric, and the dielectric loss expressed in watts equals the product of the voltage, charging current and power factor.

TEMPERATURE MEASUREMENTS

In trying to determine the cause of the repeated failures on a 13,200-volt feeder (a No. 2/0, three-conductor rosin oil base cable installed in 1914 and which will be referred to as Cable *A*), a close inspection was made of the cable where it passed through manholes, and it was found that numerous places of high dielectric loss or so-called hot spots had developed. It later happened that failures occurred at two of these places.

A maximum sheath temperature of 72 deg. C. was recorded at one of the hot spots. This is shown in Fig. 1, together with the loading on the cable. Since the temperature at the conductor will be from 10 to 25 deg. higher than the sheath, there resulted a cable temperature in excess of the A.I.E.E. recommendations.

A few days later with a somewhat lighter load on the cable the sheath temperature was recorded over a twenty-four-hour period. The load was then taken off, but potential left on, for another twenty-four hours; the temperature at the end of that time had dropped only 6 deg. C. from the maximum temperature of the cable recorded the previous day while operating with load. This temperature is shown in Fig. 2. Dielectric loss, being a function of the voltage, had accounted for a rise of 24.5 deg. C. over the base temperature and only a 6 deg. C. rise was due to I^2R loss.

It was apparent that the cable had not reached the stage where cumulative heating had started, so it was

decided to experiment in order to determine whether it was possible to cool these hot spots and lower the temperature to safe operating conditions, or at least to check the action of cumulative heating.

METHOD OF COOLING

Two 6-in. iron pipes were installed, one leading from the top and the other from the bottom of the manhole and terminating at the top of a brick wall of an industrial plant. A 12-in. office fan was then installed in the manhole in such a position that the full force of the draft would be on the hot spot. The cable was then taken out of service for twenty-four hours in order to cool to the base temperature. Fig. 3 shows the cooling curve and the rise in temperature after the load was put back on the cable. It is interesting to note that due to the heat-storage capacity of the cable and the cooling effect of the fan, the maximum sheath temperature attained was only 54.5 deg. C., whereas as shown on Fig. 1, with considerable less load and load factor, the maximum temperature was 72 deg. C.

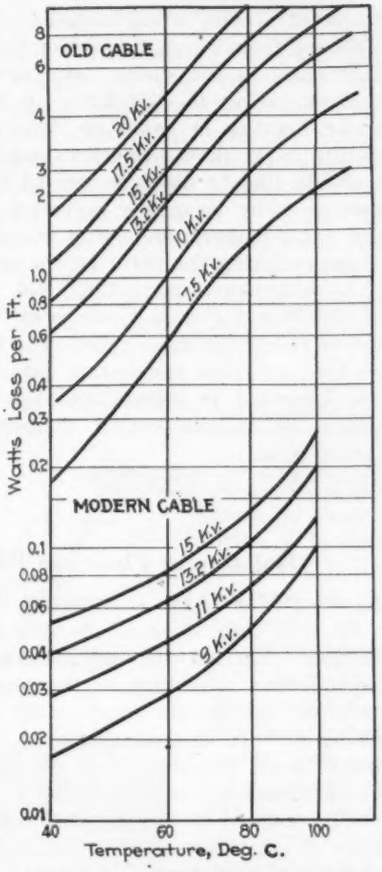


FIG. 4—DIELECTRIC POWER LOSS OF OLD AND NEW CABLES

On putting the cable back in service the maximum sheath temperature recorded during the peak heat cycle of the week was 60 deg. C. and finally with the change to cool weather the cable temperature dropped to normal. It is believed that the section of cable was saved by this method, as it was only a question of time when cumulative heating would have taken place, resulting in failure of the cable. This actually happened with two other hot spots that were under observation.

RESULTS OF DIELECTRIC LOSS TESTS

Another hot spot in the same cable at a different manhole was under observation. When it was thought that cumulative heating had started to take place, a section 400 ft. long was replaced before any failure occurred. This section was desired for test samples. Upon drawing the cable out of the duct it was found that the defective spot extended over a distance of about 50 ft.

A representative sample 13 ft. long was taken from the other end of this 400-ft. section and sent to the electrical testing laboratories for test. This section showed no signs of heating and was apparently normal. The results of this test under an operating potential of 13,200 volts is shown in the first part of Table I. A comparison was then made with present-day cables impregnated with mineral oil. A test, also made at the electrical testing laboratories on a new three-conductor cable, is given in the lower part of Table I.

The comparative cost of Cable *A* with present-day cables, based on a generating charge of $0.0075 per kw.-hr. and operating temperature of 60 deg. C., can be determined as follows: At this temperature the dielectric loss of Cable *A* is 1.82 watts per foot and for the new cable 0.10 watt, a difference of 1.72 watts, or 1.72 kw. per 1,000 ft. The cost of this loss per year at an energy rate of $0.0075 per kw. is $113 per 1,000 ft. more than for the new cable.

The cost of the new cable, assuming a life of twenty years, may be determined as follows: Assume that the scrap value of Cable *A* will pay for the installation of the new cable and the purchase price of Cable *A* is $0.70 per foot and for the new cable $1.37. Take interest on investment as 6 per cent per annum and depreciation as 5 per cent, or a total of 11 per cent. Then:

Cost of new cable per 1,000 ft. = $1,370. Operating cost per year (11 per cent of $1,370) = $150.70. Total cost of Cable *A* per year, including additional losses, = 1,000 ft. × $0.70 × 11 per cent + $113 additional losses = $190.00 per 1,000 ft. per year.

The increase in cost of Cable *A* over the new cable installed is then $39.30 per 1,000 ft. per year. The cost of the entire circuit loss per year will equal 27,000 ft. × $0.113, or $3,100, more than that of a new cable.

DECREASED CARRYING CAPACITY

The following formula for carrying capacity, using actual dielectric loss, is given by William A. Del Mar. This is based on the assumption that the entire dielectric loss occurs at the surface of the conductors:

$$I = 110\sqrt{\frac{1}{r}\left(\frac{T}{R} - W\right)}$$

Where I = amperes.
T = permissible temperature rise degrees Centigrade.
r = electrical resistance in ohms per 1,000 ft. of each conductor.
R = heat resistance from conductor to air in degrees Centigrade rise per watt lost in each inch of conductor. The value of R for No. 2/0 conductor with $\frac{7 \times 7}{32}$ in. insulation is given as 187.
W = dielectric loss per inch of cable for each phase at the ultimate temperature. This is one-thirty-sixth of the dielectric loss in watts per foot of cable.

Cable A:

$$I = 110\sqrt{\frac{1}{0.0970}\left(\frac{85-40}{187} - \frac{4.65}{36}\right)}$$

= 118 amp. carrying capacity of Cable *A*.

New Cable:

$$I = 110\sqrt{\frac{1}{0.0970}\left(\frac{85-40}{187} - \frac{0.2}{36}\right)}$$

= 171 amp. carrying capacity of new cable.

Cable at Hot Spot:

$$I = 110\sqrt{\frac{1}{0.0970}\left(\frac{85-40}{187} - \frac{6.5}{36}\right)}$$

= 87 amp. carrying capacity of the cable at a hot spot.

This is based on a test that was made of a short section of cable cut from one of the hot spots, which showed a loss of 6.5 watts per foot at 85 deg. C.

COMPARISON WITH A.I.E.E. RULE

The formula can be written in the form

$$I = 110\sqrt{\frac{1}{r}\left(\frac{T'}{R}\right)}$$

Where

$T' = T - WR$

T_0 = base temperature

The A.I.E.E. rule states that $T' = 85 - T_0 - E$

But $T = 85 - T_0$

Then $85 - T_0 - WR = 85 - T_0 - E$

Therefore $WR = E$

In the case cited of the old cable $WR = 24$ and $E = 13.2$ kv.

For the new cable $WR = 1.03$ and $E = 13.2$

TABLE I—COMPARISON OF OLD AND NEW C

Temperature, Deg. C.	Watts Loss Per Ft.	Power Factor, Per Cent
Cable *A*, three-conductor, No. 2/0, $\frac{7\times7}{32}$ in. paper ¼-in. lead:		
40	0.59	14.0
60	1.82	36.4
80	4.10	52.0
100	6.45	66.0
New cable, three-conductor, 350,000 circ.mil $\frac{7\times4}{32}$ in. paper ¼-in. lead:		
40	0.04	0.4
60	0.06	1.0
80	0.10	2.0
100	0.21	3.3

To satisfy the equation where $WR = E$ and the rule will apply, it is apparent that the watts loss per foot is some value between these two extremes.

Then if $\frac{WR}{36} = E$, $W = \frac{36E}{R}$

With 13,200-volt cable, $W = \frac{36 \times 13.2}{187}$

$= 2.54$ watts loss per foot of cable.

From this it is obvious that the rule is not applicable to old cables with very high loss or to modern cables with low loss; also that dielectric loss is not a governing factor in the operation of the modern cable, and to obtain the highest efficiency from them cables of recent design should be operated at a higher temperature than 85 deg. C.

CONCLUSIONS

Neglecting the hot spots, it is apparent from this comparison that the old cable has only 69 per cent of the carrying capacity of a modern cable, and if this is further considered in the comparative cost, it would add materially to the saving in the installation of a new cable; also due to the superior thermal qualities of the dielectric in the present-day cables, the heat generated is dissipated at a higher rate and consequently will be able to carry higher peak loads for short periods.

Another factor to be considered in these high dielectric loss cables is the high cost of upkeep and loss of service, and it seems that more attention should be given to them, and where it is found economic, they should be replaced.

Letters from Our Readers

Dielectric Losses in Cables

To the Editor of the ELECTRICAL WORLD:

In your issue of June 13, R. W. Atkinson points out in connection with some results given at the World Power Conference last year that the dielectric power factor of a cable when heated electrically may be very different from what it is when the length is heated by immersion in hot water. He states that for this test current rating is customary in Europe, and that as water heating is usual in America comparative test results may show American cables to disadvantage. I should like to place on record the fact that current heating is by no means universal in this country, several cable makers employing water heating as a result of appreciating the point raised by your correspondent. If he will turn to page 1287, Vol. 3 of the Proceedings of the World Power Conference he will see that the writer raised the same question in the discussion. Until we have collected more exact data on the seat of dielectric losses, it is imperative that the whole dielectric should be at one known temperature during power factor tests.

P. DUNSHEATH.

Henley's Research Laboratories,
Gravesend, Kent, England.

Isolation of Phases in Power Houses

To the Editor of the ELECTRICAL WORLD:

In your July 4 issue the article "American Power Stations" carried the subheading "Tendencies which improve the reliability of the power station, increase its cost, but do not appreciably affect the operating efficiency." In this subheading I note that the isolated phase layout and the use of reactors and other protective devices have been included and grouped.

With regard to the isolated phase layout, the character of this development is such that it should be credited with future economies which will be realized when the principle is extended to the cable system. The isolation of phases in power houses is but the first step toward the universal control of faults on power systems, and with the application to cable systems, reactors, protective gear and high-capacity breakers will be greatly reduced in number and the inherent economy of the whole system apparent in the electrical end of the generating station. Incidentally, there will be an improvement in the operating efficiency consequent upon the reduction in the number of reactors.

B. G. JAMIESON,
Engineer of Inside Plant.

Commonwealth Edison Company,
Chicago, Ill.

Water Power Utilization in Spain

ACCORDING to an industrial map of the province recently drawn up by the Barcelona Chamber of Industry water power to the extent of 326,175 hp. is now being used in Catalonia.

The major portion of this power, 268,813 hp., is used for hydro-electric purposes, 38,968 hp. in textile mills, 7,657 hp. in cement, carbide and allied works, 5,196 hp. in flour mills and 3,441 hp. in the paper and cognate industries.

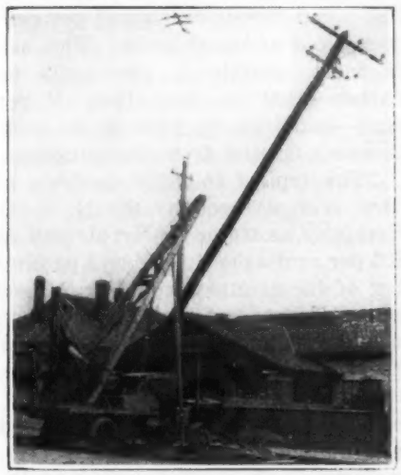
Central Station and Industrial Practice

Distribution Practice in Australia

BY F. W. H. WHEADON
Engineer and Manager Adelaide Electric Supply Company, Ltd., Adelaide, Australia

FROM the ten main 33,000-volt transformer substations of the Adelaide Electric Supply Company primary distribution is effected at 7,600 volts, three-phase, four-wire and connects altogether 325 single-phase and three-phase transformer stations, mostly of the pole-mounted type.

At these pole-mounted transformer stations 4,000/400/200-volt single-phase transformers are used, connecting the phase wire to neutral. The adoption of the intermediate



POLE ERECTOR LIFTING 50-FT. POLES IN AUSTRALIA

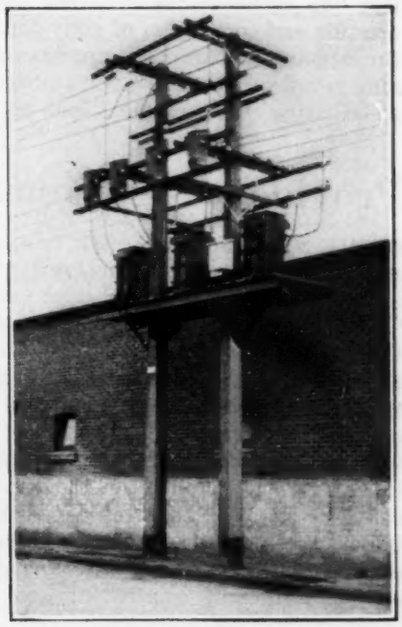
pressure of 7,600 volts was due partly to the fact that transformers to step down directly from 33,000 volts to 440 volts in the smaller sizes, as required for these distributing stations, are very costly, and partly that this pressure enables the company to utilize a large number of single-phase 4,000-volt transformers and concentric cable previously used in connection with its single-phase system.

As a temporary expedient, considerable use has been made of the open delta system of supplying three-phase, but it is intended to complete gradually the three-phase banks on account of the improved voltage regulation. Where three-phase transformers are installed, the connection of the star point to the neutral of the 7,600-volt line is omitted, to avoid burning out transformers, which may occur under fault conditions, owing to such banks with their neutrals connected endeavoring to maintain the balance of the different phases.

A further advantage of operating these banks with the neutral disconnected is that in case of a transformer fuse blowing, the bank immediately becomes single-phase with 7,600 volts across two 4,000-volt transformers in series. The combined effect of single-phasing with low voltage shuts down all the three-phase power load until the fuse is renewed. This is preferable to the bank continuing to operate in open delta, as it would do with the neutral connected, resulting possibly in the burning out of the two other transformers. It has, however, been found necessary to connect the neutral temporarily while installing transformers, as otherwise triple harmonic voltages appear on the secondary side when making the necessary phasing-out tests before closing the delta. When the delta is closed, on completion of the tests the neutral connection, which is in the form of a fuse, is removed.

No trouble has been experienced, other than the one just mentioned, from triple harmonic currents or voltages. Distribution transformer stations are protected on their 7,600-volt side by fuses of the tetrachloride type. Such fuses are used for short-circuit protection only and are unaffected by overload on the transformers. A routine system of maximum load readings is relied upon to prevent overloading. Trials are also being made with various types of thermal indicators, inserted in the transformer oil. The tetrachloride fuses are mounted upon the pole crossarm in boxes of the company's design, arranged so that the act of opening the door of the fuse box withdraws the fuse from the contacts.

Lightning arresters of the autovalve type with choke coils are being installed on distribution transformer stations. On the 440-volt side the three-phase banks are connected in delta, the middle point of one phase being earthed and connected to the middle wire of the three-wire system for the 200-volt lighting and single-phase load. The 400-volt single-phase motor load is balanced on the three phases wherever the three-phase lines are available. In residential districts the lighting load may be greater than the power load, in which case a large transformer for the lighting load is coupled in open delta with a smaller one to supply the limited requirements in three-phase power.



TYPICAL DISTRIBUTION TRANSFORMER STRUCTURE USED BY ADELAIDE COMPANY

In the power districts three transformers are generally used, one of them being larger than the others, to take care of the industrial lighting that may be required simultaneously with the motor load. In a few cases an extra transformer is provided to deal with the industrial lighting load. So far, only single-phase distribution transformers have been used, but three-phase units will probably be used for all extensions where the load balances will allow.

In connection with the change-over of the system from single-phase to three-phase distribution, one of the greatest difficulties was the erec-

tion of the additional conductors without undue interference with the industrial power load, which made the work of change-over slow and tedious, much of it having to be done on Sundays. As the mains extended over 600 miles of streets, all single-phase, the remodeling of this to a complete three-phase network is obviously a matter of time. It is expected, however, that many of the residential districts will always remain on single-phase. In order to keep down the demand for three-phase, during this change-over period, to an amount which the main staff could deal with, a regulation was made limiting the supply of three-phase power to new installations having more than 20 hp. connected load. Even with this limitation the demand has required the erection and connection of sixty-four three-phase transformer stations in nine months. When the three-phase distributing network has been extended, it is the intention to reduce the horsepower limitation for three-phase power. In the city of Adelaide itself (having an area measuring about one and one-quarter miles to two and one-quarter miles), the supply was originally all direct current, but a study of the probable development of that system showed that it would be more economical to convert certain portions of this, mainly residential and shops, to the alternating-current system also. This change-over from direct current to alternating current has now been completed, consumers' direct-current motors in these areas being taken over by the company, and replaced by alternating-current motors without charge to the consumer. The city alternating-current area is supplied from a 33,000/7,600-volt substation at Wilcox Street, and the direct-current area, being the central business area, from a rotary-converter station at East Terrace.

Providence Considering Smoke Abatement

THE Narragansett Electric Lighting Company is giving serious consideration to the question of "smoke abatement" in connection with the modern addition being made to its South Street Station. Since this is an active problem of all central stations at this time, the following quotations from a report made to E. A. Barrows, president of the company, by H. W. Ballou, of Jenks & Ballou, the company's consulting engineers, are of especial interest to other engineers considering this question:

"Cinders are herein defined as lumps of coke—that is, partly burned coal—of a diameter varying from as large as ½ in. down to perhaps 0.05 in. Ash is finely divided particles of non-combustible parts of the coal, a large majority of which may have a diameter of from 0.001 in. to 0.0001 in. Even if combustion could be perfect, there would still be flue dust, because coal is not a pure fuel. Some of the non-combustible parts of the coal—that is, 'ash'—will always pass up the chimney.

"The flue dust from stokers consists largely of coarse cinders with very little ash, whereas that from powdered coal consists of fine ash and almost no cinders. Dr. Kreisinger, of the Combustion Engineering Corporation, estimates the 'flue dust' from such superpower plants as Beach Bottom, Springdale and Colfax as about 5 per cent of the weight of the coal.

"Cinders, owing to their size, soon reach the ground. Between 75 per cent and 90 per cent of the total quantity of 'cinders' rising from a chimney are usually deposited within a mile of the power plant. Ash (especially that from powdered coal), being of the fineness of volcanic dust, remains suspended for long periods, and is so widely dispersed that its deposition is practically untraceable.

"Dr. Kreisinger estimates that 90 per cent of the dust from powdered coal is carried by the air more than five miles from the stack. While conducting a recent test of the powdered coal plant of the United Electric Railways at Manchester Street (for the Combustion Engineering Corporation) he has measured the percentage of ash in the chimney gases and presented us with a jar of ash so caught, the average fineness of which is estimated by Dr. Kreisinger to be less than 0.0001 in., or finer than volcanic dust, such as remains in the air for months and has wide dispersion.

"The coarser parts of the ash from powdered coal are supposed to deposit themselves practically as follows: About 25 per cent in the ash pit of the furnace; about 15 per cent or 20 per cent in the second pass of the boilers; about 15 per cent in the base of the economizer (or air preheater), and about 40 per cent or 45 per cent passes out of the chimney. This ash is inert, containing practically no carbon—that is, less than 5 per cent—and imparts little or no color to gases issuing from the chimney.

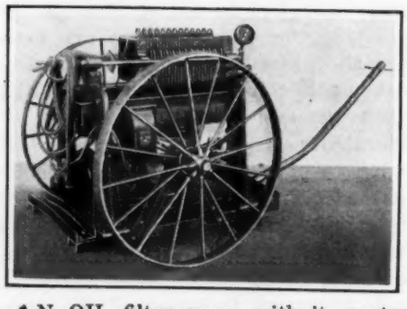
"The typical chemical analysis of 'dry' coal, as used by the N. E. L. Company, as stated by Mr. Metcalf, is 5.6 per cent ash; 40 per cent passing out of the chimney would be 2.2 per cent; 5 per cent unburned carbon would thus amount to 0.1 per cent of the weight of coal discharged upon the community in the form of carbon, of which 90 per cent will pass beyond a five-mile radius. The carbon remainder is thus one ten-thousandth part.

"With stokers and cinder catchers, the carbon passing out of the chimney as cinders would be from 2 per cent to 5 per cent of weight of coal times 75 per cent unconsumed carbon times 25 per cent passing the cinder catcher equals 0.3 per cent to 0.8 per cent. Thus the quantity of unconsumed carbon—that is, the nuisance-producing matter—in the cinders and ash from a stoker-fired plant with cinder catchers may be from three to eight times as great as from powdered coal.

" 'Smoke' has been minimized from the great power plants of this country by the combustion control indispensable to plant efficiency. Your new plant will have the latest and most effective devices of this sort.

"Cinders and ash do not impart to chimney gases the color called 'smoke.'

Portable Oil Filter for Substation Use



AN OIL filter press with its motor and other equipment has been conveniently mounted on a steel wheel cart by the Pacific Gas & Eectric Company for use around its large substations. The accompanying illustration shows one of these portable outfits at Newark substation. The engineering department of the company is responsible for its design.

"Cinders and ash do distribute the nuisance-producing coke called unconsumed carbon.

"The big power plants of New York City have thus far excelled in removing such carbon from chimney gases.

"The chimney gases from your new plant are expected to throw abroad over the community much less carbon than is the case in New York, and attain a degree of excellence in this respect at least equal to any other present or projected plant in the United States."

Short-Circuit Calculating Board

Description and Operation of Equipment Made for This Purpose by Southern California Edison Company

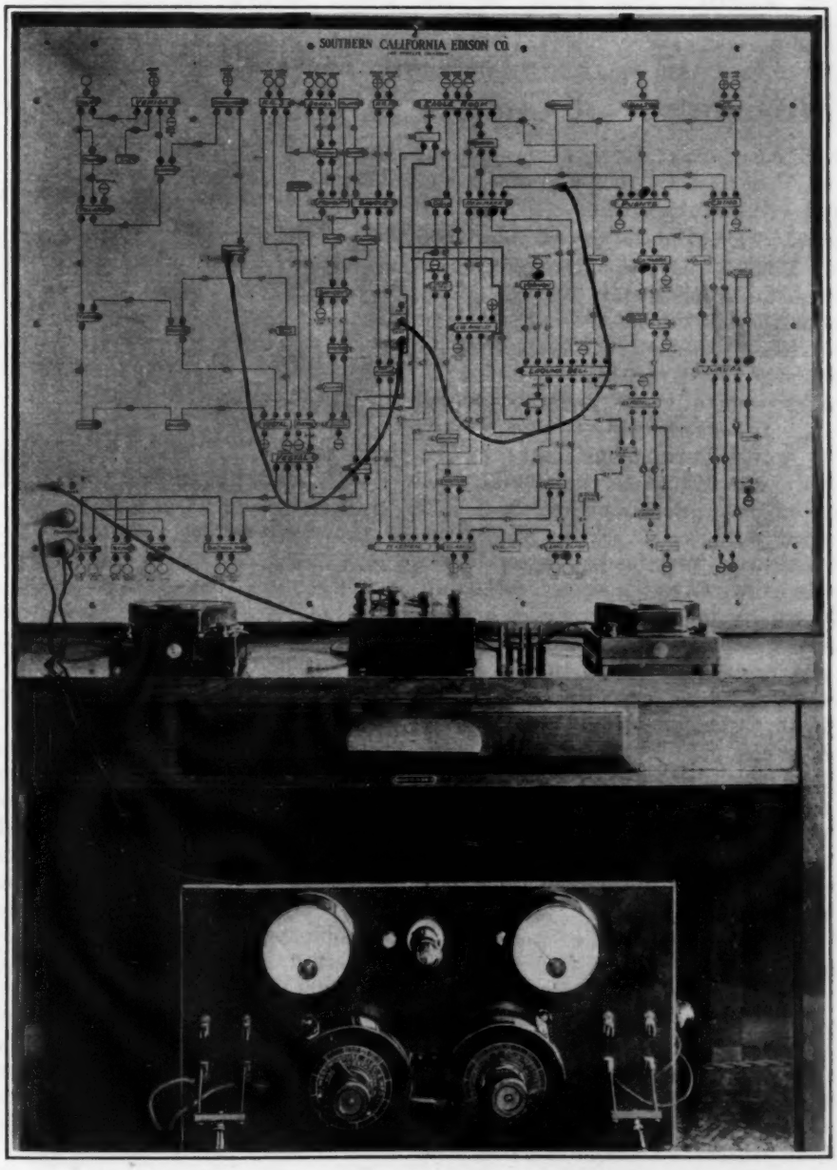
BY E. R. STAUFFACHER
Protection Engineer, Southern California Edison Company, Los Angeles, Cal.

THE application of oil circuit breakers in the generating plants and substations of a system such as that of the Southern California Edison Company demands that the current-interrupting duty of the oil circuit breaker at times of severe short circuits be definitely determined in advance. To aid in the solution of such problems a calculating table has been built and used for the past few years. This equipment is in the form of a cabinet in which suitable resistance units and telephone jacks are mounted and connected in the same electrical relation as the 220-kv. and the 60-kv. transmission systems. The front of the cabinet is a three-ply, 4-ft. x 3-ft. wooden panel, enameled in white, on which a diagram showing the power houses, substations, switching stations and transmission lines is painted.

The reactance of each generator, transformer and synchronous condenser was obtained from data furnished by manufacturers of this equipment and the reactance of the transmission lines was calculated from the physical characteristics of these lines. In designing the calculating board these reactances were reduced to reactance values based on 500,000 kva. When installed on the calculating board, these reactance values are represented by equivalent values of resistance. Each generator, transformer, transmission line and synchronous condenser on the 220-kv., 150-kv. and 60-kv. systems is, by this means, represented by the proper value of resistance that is connected to the adjacent resistance in the same electrical relation as the actual equipment in use on the transmission system. The resistances corresponding to the generating equipment are connected between the network of resistances and the positive busbar, while the resistances corresponding to the remaining equipment and transmission lines are connected between the network and the negative bus. Means are then provided to impress a potential of 100 volts, direct current, furnished by a 500-watt motor-generator set, across the negative and the positive busbars. At each location representing a station bus and in the middle of each transmission line suitable permanent taps are brought out from the network to the front of the board. Telephone jacks, designed to be normally closed, are provided in each position corresponding to each major oil circuit breaker on the system.

OPERATION OF THE BOARD

Convenient means are provided to impress a direct-current potential of 100 volts across the network and to put a three-phase short circuit on the system at any point desired. This short circuit is accomplished by means of a flexible wire of negligible resistance permanently attached at one end to the negative bus. The other end is provided with a clip so



CALCULATING BOARD SIMPLIFIES COMPUTATION OF SHORT-CIRCUIT CURRENTS ON LARGE NETWORKS

that the lead may be readily attached to any of the taps at a substation bus or on a transmission line and thus produce the short circuit. A telephone plug can then be inserted in any of the telephone jacks used to represent the oil circuit breakers on the actual transmission system and by this means the current flowing in this switch at the time of a short circuit can be determined. It is also possible to measure the total current in a short circuit on a bus and to determine in which direction the current is flowing under these conditions.

In taking readings with the calculating board it is only necessary to be careful to see that the voltage is correct before a current measurement is taken. The value of current indicated is multiplied by a constant of 500,000. This gives the instantaneous value of the short circuit in kilovolt-amperes. It is then necessary to apply the proper decrement corresponding to the system reactance and relay time setting of the oil circuit breaker at this point on the transmission system. The kilovolt-amperes obtained can then be reduced to amperes at the voltage under consideration.

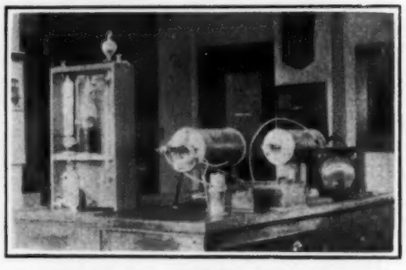
While this calculating board does not permit the flexibility as regards changes in equipment and transmission lines that the usual type embodying adjustable rheostats permits, yet the saving in cost and the greater simplicity are of considerable advantage. As it is designed for the specific use of one system, the changes necessary as the system expands will not be a big burden.

The writer wishes to give credit to H. E. Barden and L. F. Hunt for the design and to F. Dengler for the construction of the board.

Resistance of Copper at High Temperature

BY PAUL CLOKE
Professor of Electrical Engineering,
University of Arizona, Tucson, Ariz.

A GREAT deal of interest has lately been manifested in the resistance of metals at high temperatures. About a year ago the writer started an investigation to determine the resistance of copper at high temperature. Several samples of No. 36 copper wire were sent in by an Eastern manufacturer. The wire was wound on the outside of a silica tube closed at one end and open at the other. The ends of the small wire were fused to a very large copper wire, which served as lead-in wires from a Wheatstone bridge, which was used to determine the resistance. This silica tube was inclosed in a larger silica tube, which in turn was inclosed in a resistance type electric furnace. The temperature was determined with a base-metal couple and a Northrup pyrovolter. Inert nitrogen was led through the outer silica tube so that the copper was in a non-oxidizing atmosphere.



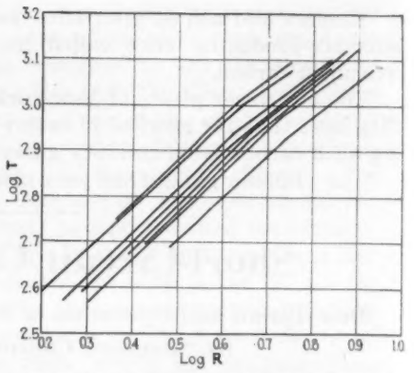
APPARATUS FOR COPPER RESISTANCE—TEMPERATURE RESEARCH

Considerable trouble was experienced from oxidation, but this was entirely overcome by passing nitrogen through a chemical purifier consisting of a tube of soda lime and potassium hydroxide to remove CO_2, then a tube of pyrogallate to remove oxygen, a tube of pumice saturated with concentrated sulphuric acid and finally a tube of calcium chloride and phosphorus pentoxide to remove water vapor. This was followed by a tube of copper filings and wire heated to a red heat. Thus every trace of any substance that might attack the copper sample was removed.

The readings were checked by taking observations both ascending and descending. The possibility of the silica being conducting at high temperatures was also checked. The samples tested had a resistance at room temperature of from 1.5 ohms to 2 ohms and 6 ohms or 7 ohms at temperatures ranging from 600 deg. C. to 900 deg. C.

From the data a table of values was made giving the resistance, the temperature Centigrade, the temperature absolute, the logarithm of the resistance and the logarithm of the absolute temperature.

These values were plotted in an endeavor to discover the law of the variation. The logarithm of the resistance plotted against the logarithm of the absolute temperature gave a straight line. The fact that these plots give a straight line shows that the resistance varies as some exponent of the absolute temperature. There is an abrupt change in the slope at about 600 deg. C. Using the Σ—Δ method on about 350 sets of observations, the average slope below 600 deg. C. was 1.049, showing that R varies as $T^{1.049}$. This gives a very simple relationship for computing the resistance up to 600 deg. C. of any sample of copper of commercial conductivity. The average slope above 600 deg. C. was 1.243, showing that R above 600 deg. C. varies as $T^{1.243}$.



RELATION BETWEEN TEMPERATURE AND RESISTANCE OF COPPER

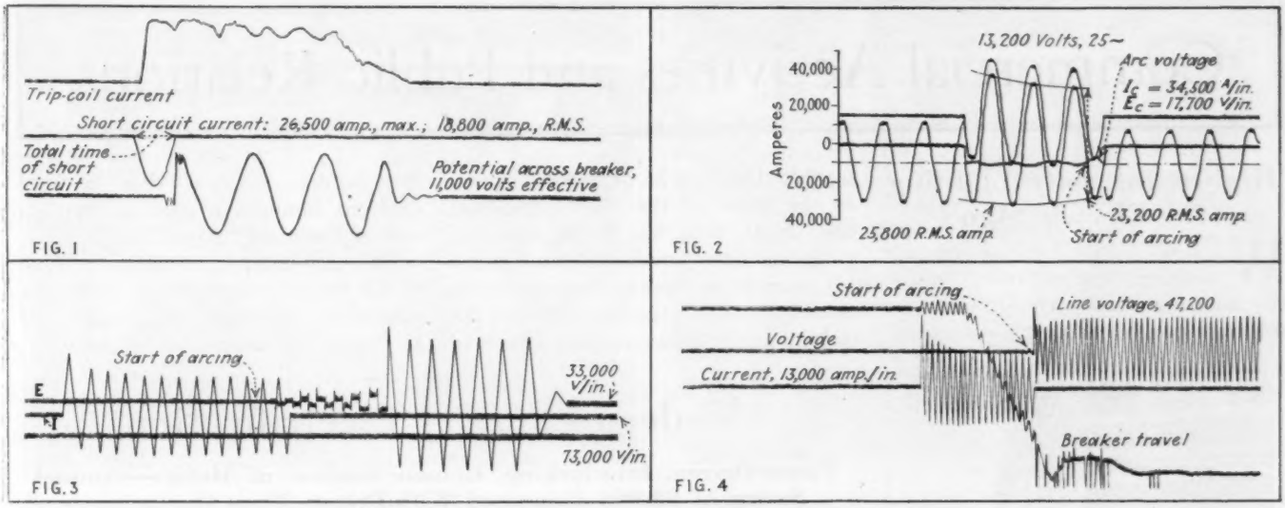
Several curves are given simply to show the general trend. Many curves were coincident due to the same initial resistance and temperature.

It is also to be noted that the exponent 1.049 gives results in very close agreement with the formulas in common use for computation of resistance of copper at comparatively low temperatures.

The author is indebted to Dr. T. Buehrer of the department of chemistry for aid in the designing and constructing of the chemical purifier.

SLOPES OF THE LOGARITHMIC CURVES IN TEMPERATURE-RESISTANCE ANALYSIS

Test Number	Below 600 Deg. C	Above 600 Deg. C	Conductivity
1	0.988	1.017	97.2
2	1.130		
3	1.020	1.310	97.2
4	1.060	1.405	97.4
5	1.050	1.340	97.4
6	1.123	1.290	97.7
7	1.128	1.250	97.7
8	1.043	1.255	97.1
9	1.046	1.226	97.5
10	1.072	1.153	96.9
11	1.092	1.267	96.9
12	1.100	1.217	97.6
13	0.957	1.118	97.6
14	1.020	1.176	97.8
15	0.943	1.159	97.6
16	0.899	1.176	97.9
17	1.044	1.320	97.0
18	1.080	1.345	97.7
19	1.130	1.159	97.3
20	1.065	1.343	98.3
21	1.067	1.385	96.9
22	1.025	1.167	96.9
23	1.065	1.278	98.3
Aver.	1.049	1.243	97.45



PERFORMANCE OF CIRCUIT BREAKERS AS SHOWN BY OSCILLOGRAMS

Fig. 1—Special high-speed breaker.
Fig. 2—Action of commercial breaker on 23,200 r.m.s. amp.
Fig. 3—Ordinary speed circuit breaker opening 3,000 amp.
Fig. 4—High speed breaker opening 5,000 amp.

Oil Circuit-Breaker Performance

WHEN discussing the paper on oil circuit breakers presented by E. C. Stone at the recent summer convention of the A.I.E.E., J. B. McNeill of the Westinghouse Electric & Manufacturing Company showed several oscillograms of breaker performance. Four of these oscillograms are shown above.

The action of a special high-speed breaker opening up a root mean square current of 18,800 amp. is shown in Fig. 1. The total time of breaker operation, including the time of the relay, the tripping mechanism, the movement of the contacts and the magnetic blowout, was one-half cycle on a twenty-five cycle circuit, or 0.02 second. This oscillogram indicates the extreme speed of breaker operation that can be obtained by the application of the blowout principle.

An oscillogram of an ordinary commercial breaker opening up 23,200 r.m.s. amp. in the arc is shown in Fig. 2. The total period of arcing is one-half cycle on a twenty-five circuit. Thus, with an ordinary commercial breaker structure properly designed, the magnetic blowout principle can be used to obtain very fast time of arc interruption.

The action of an ordinary speed circuit breaker when opening up approximately 3,000 amp. on a 44,000-volt circuit is shown in Fig. 3. The time of arcing is eight cycles on a sixty-cycle circuit, or 0.13 second. This action is to be contrasted with that shown on Fig. 4, which shows the interruption of a similar circuit carrying approximately 5,000 amp. at 44,000 volts by means of a breaker equipped with high-speed contacts. The total time of arcing in this latter case is two and one-half cycles on sixty-cycle, or 0.04 second. This is less than one-third the time required by ordinary speed breakers.

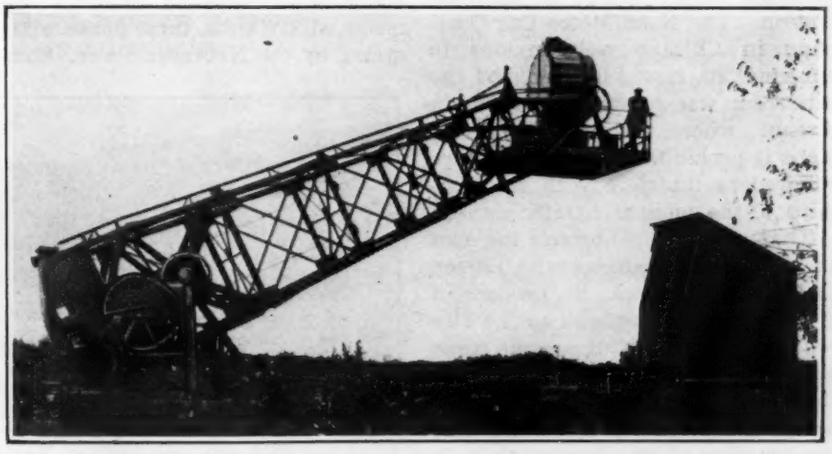
The conclusion to be drawn is that considerable progress in the circuit-breaker art can be made by the utilization of well-known principles of design that are entirely commercial in their application.

Towers for Carrying Searchlights

SEARCHLIGHT towers that rise and disappear are now part of the equipment of the seacoast service. They have been designed to carry 60-in. searchlights. As these structures are supported on a trunnion shaft, they can be quickly raised or lowered. When the tower is lowered, the whole structure may be concealed from view by adjacent trees or hillocks. Lowering the searchlight to the ground makes it an easy matter to store it properly or to make any repairs or adjustments.

The towers that have been built range in height from 45 ft. to 100 ft., but the design is practically the same for all. At the top of the steel frame is provided a swinging platform. The searchlight is centrally placed on this. There is room for several men to work around the light. The light has an intensity of about four billion candlepower. The tower complete weighs about 4 tons.

One man is able to operate any of the towers. In less than a minute he can raise or lower one of the smaller towers. Hand operation eliminates any danger of shocks in starting and stopping. The tower can be held securely at any angle. When the searchlight is not in use, it is inclosed in a small steel house. This house is mounted on wheels.



DISAPPEARING SEARCHLIGHT TOWER USED FOR SEACOAST SERVICE

Commercial Activities and Public Relations

Higher Intensity Lighting for Electric Sign

WHERE city ordinances or building restrictions prohibit the hanging of electric signs across sidewalks or on principal thoroughfares this handicap can sometimes be overcome, where the location permits, by special design of the sign or increasing the size of the lamp used. Recent installation by the Commonwealth Edison Company of the sign shown serves as an illustration. The Nash Motor Car Company in Chicago was anxious to announce its new Ajax car, but the salesroom was located on Michigan Avenue, where the use of flashing signs is prohibited, because they are believed to interfere with the visibility of the automatic traffic signals.

HIGHER CANDLEPOWER LAMPS IN THIS SIGN OVERCOME DISADVANTAGE OF LOCATION

To overcome this obstacle the sign bureau of the Commonwealth Edison Company undertook to produce a sign that would conform to the city regulations and at the same time be a valuable advertising medium for the user. It was decided to use higher candlepower lamps in the construction of the border than is ordinarily considered necessary, placing them in a depressed groove at the sides of the sign instead of the usual trough. With this arrangement two rows of 25-watt lamps give a more brilliant effect than four rows of 10-watt lamps. There are 286 25-watt, amber-colored lamps in the border. Twenty-five 25-watt daylight lamps are used in the letters of the word "Ajax."

The sign has a total connected load of 8.5 kw. and is believed to be the equivalent of many older signs of five times the connected wattage.

Modern Laundry Electrification

Power-Driven, Interlocking, Remote Control of Motors—Annual Saving of $2,000 Compared With Private Plant Operation—Use of Exhaust Steam for Heating Water Impracticable

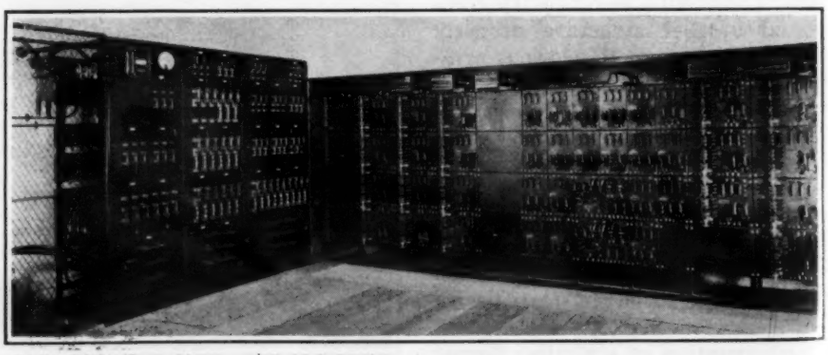
BY FORD BATES
Assistant Sales Manager Nebraska Power Company, Omaha, Neb.

THE Kimball Laundry, with a new and modern plant in Omaha, Neb., has an electric installation of approximately 200 kw. in motors, lighting and electrically heated appliances. The company had formerly used a private plant, but decided on central-station service for its new building, because it would be more economical than the operation of a private steam plant. The motors are, for the most part, of small rating, ½ hp. to 6 hp., with an occasional larger motor. The lighting installation is designed to give uniform, general illumination, with added intensities in particular locations; the electrically heated appliances consist principally of flatirons and small appliances for special purposes. Steam for heating the building, water and machines is supplied from a 225-hp. vertical boiler operating at 140 lb. steam pressure.

All electric service for power, light, heating appliances and battery charging is supplied through one meter, at 220 volts, three phase, sixty cycles, by the Nebraska Power Company. Views of the electrical equipment are shown in the accompanying cuts.

The operations carried out in the laundry are chiefly material handling, washing, drying, ironing and finishing. Material handling is effected by means of gravity and power conveyors; washing is done in machines of the cylinder, reversing type, and drying is carried out first in centrifugal extractors and later in power-ventilated tumbler driers. Ironing and finishing are done on cylinder machines, pressing machines and under electrically heated flatirons.

The washing machine and extractor motors start under load and the washing machine motors are reversed at short intervals. For the operation of these motors small control stations are located at each machine, but the main control switches are located in a separate room and are arranged on a power-operated, remote-control, interlocking switchboard. Since the motors are started or reversed under full voltage, it is desirable so to interlock their start-



REMOTE-CONTROL, INTERLOCKING SWITCHBOARD USED IN STARTING AND REVERSING MOTORS, WITH MAIN POWER AND LIGHTING SWITCHBOARD AT LEFT

WASHING MACHINES EQUIPPED WITH REVERSIBLE MOTORS

ELECTRIC IRONING EQUIPMENT WHICH ADDS TO THE LOAD

ing or reversing periods as to prevent more than one motor starting at the same time. When using this interlocking control the fluctuations of current in the main service are but a fraction of what they would be were all the motors allowed to start independently. The accompanying chart, taken from an ammeter in the main service, shows the maximum momentary change in current in the main service to be no greater than the starting current of a single motor. Without the interlocking control, it would be possible for as many as ten 3-hp. motors, and perhaps more, to start simultaneously, causing a current fluctuation of more than ten times the value shown in the charts.

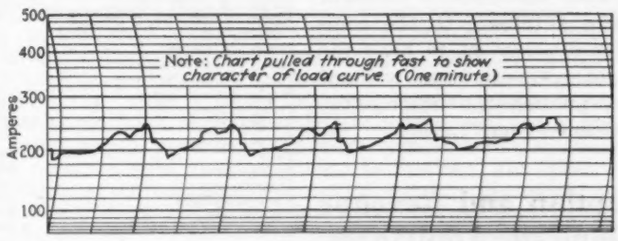


CHART SHOWING AMPERES PER PHASE IN MAIN SERVICE DURING ONE MINUTE OF LAUNDRY OPERATION

The use of this remote control board has removed from the workrooms equipment that would catch dirt and be difficult to maintain in the presence of so much moisture.

ANNUAL SAVING WITH PURCHASED POWER

Coal and supplies	$3,000
Labor of one man	1,500
Fixed charges (20% on $10,000)	2,000
Gross saving	$6,500
Annual power bill	4,500
Net annual saving with purchased power	$2,000

NOTE—The above figures include power for charging five electric delivery trucks.

The hot water requirements of the modern laundry are severe in the extreme. The water must not only be hot, but it must be available instantly and in large quantities, since with twenty machines in operation it is possible for the demand for water at 140 deg. F. to reach 1,000 gal. per minute. Such demands for hot water cannot well be met by exhaust steam heating, so the problem of supplying sufficient quantities of hot water at the high rate demanded makes high-pressure steam the most economical method of heating and precludes the possibility of the economical production of power, because of the inability to use the exhaust steam for heating.

NET ANNUAL SAVINGS OF $2,000

The gross reduction in operating expenses of the Kimball Laundry, compared with steam plant operation, amounts to $6,500 per year. The cost of purchased power is approximately $4,500 per year. The net annual saving with purchased power is $2,000, as shown in the accompanying tabulation.

As a part of its delivery service, the Kimball Laundry uses five electric trucks on its shorter routes. In addition to other advantages for laundry service, the electric trucks are cleaner and require less valuable garage space than do the gasoline trucks.

Range Load Developed Through Co-operation

CO-OPERATION between the central station and electrical contractors and dealers is strongly advocated by D. C. Hess, manager of the municipal electric light and power plant at Richmond, Ind., who finds such co-operation especially valuable where, as in the case of Richmond, the central station does not sell merchandise. Mr. Hess is also an ardent believer in the value of the electric range load. He is likewise an advocate of central-station advertising and has sold the idea of advertising to his city council until it has this year approved an advertising appropriation of four times the amount it would vote two years ago. When tackling the local contractor-dealers Mr. Hess found little interest in either electric ranges or advertising. Since the co-operative plan has been put into effect one dealer has gone so far as to take an entire page in the local newspaper for electrical advertising.

The plan of co-operation worked out in Richmond has been centered around the electric range, but might easily be extended to other merchandise. A few months ago an agreement was signed between the central station and five contractor-dealers whereby the facilities of the former's office are to be used jointly by the dealers in the display of electrical merchandise. Each dealer is to carry only one model of a particular manufacture, and if the pros-

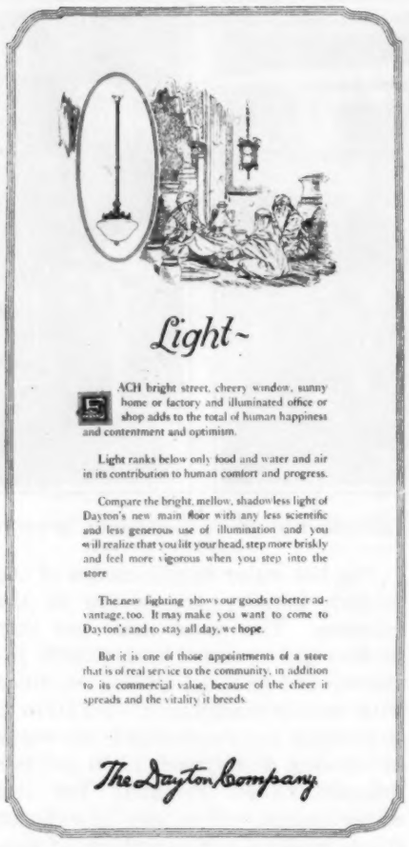
pect wishes to see other models he can be taken to the central-station office and offered the widest possible selection. Space in the office is devoted to the display of any merchandise that a dealer may wish to call to the attention of customers.

In addition to the co-operative display, there has been arranged a co-operative advertising campaign wherein the central-station pays one-fourth of the electric range advertising, the dealers jointly pay one-fourth and the range manufacturers pay one-half. The agreement provides for three outside salesmen to be hired by the dealers and to be paid a commission of 15 per cent with a guarantee of $100 per month. The central station pays the salary of a range demonstrator and has provided space and equipment for a permanent display of a model kitchen and a model dining room. In the display rooms public demonstrations are conducted, supplemented by demonstrations in the homes of prospects and users of ranges.

In the office of the central station is a map showing the location of every electric range. A study of this map shows that ranges tend to gather in natural groups around the initial installation of a neighborhood. This occurrence suggests one reason for the fact that there has been very little expense in serving the range load. Occasional increases in the size of transformer and some slight rearrangements have constituted all the expense incurred. In one location it was found that six ranges and 6 kva. in lighting were being well served from one 10-kva. transformer. Range business has been served in one section of Richmond where the addition of more than seventy ranges did not affect the station peak, although the range customers amounted to a large percentage of the total customers served. Such a condition indicates a tremendous diversity for the electric range load.

New Lighting Installation Advertised

AN IMPORTANT factor in the successful development of commercial lighting is the pride a merchant takes in the improved appearance of his store as a result of a new lighting installation. When the main floor of the Dayton Company's department store, Minneapolis, Minn., was relighted along the lines specified by the Northern States Power Company, the company did not foresee how much pride the owners of the new installation would take in the improved appearance of their store. It was, therefore, a pleasant surprise and a tribute to the company's sales department to have the customer unexpectedly and without solicitation publish the accompanying advertisement on "Light."


Light-
EACH bright street, cheery window, sunny home or factory and illuminated office or shop adds to the total of human happiness and contentment and optimism.
Light ranks below only food and water and air in its contribution to human comfort and progress.
Compare the bright, mellow, shadowless light of Dayton's new main floor with any less scientific and less generous use of illumination and you will realize that you lift your head, step more briskly and feel more vigorous when you step into the store
The new lighting shows our goods to better advantage, too. It may make you want to come to Dayton's and to stay all day, we hope.
But it is one of those appointments of a store that is of real service to the community, in addition to its commercial value, because of the cheer it spreads and the vitality it breeds.
The Dayton Company

AN UNEXPECTED TRIBUTE TO THE VALUE OF BETTER LIGHTING

Consumption and Revenue from Domestic Appliances

FREQUENTLY the question arises as to how much energy consumption and gross annual revenue may be expected from the use of the principal household electrical appliances. Energy consumption will, of course, vary with the habits of individual customers and revenue depends upon the rates in effect. However, a table showing the relative demand and consumption, together with the approximate revenue, is often useful in making up estimates of the probable value of the different loads.

Such a tabulation has been prepared by F. W. Herbert, director of the N. E. L. A. service department. The figures as given in Table I are based on the composite experience of a number of central-station companies in all parts of the country and $0.084 has been assumed as the average lighting rate and $0.0325 the average cooking rate. Table II shows the average wattage and earnings of electrical appliances based on a rate of ten cents per kilowatt-hour, which can easily be changed to agree with a higher or lower rate.

TABLE II—AVERAGE WATTAGE AND EARNINGS OF ELECTRIC APPLIANCES
Based on Rate of 10c. per Kilowatt-Hour

Appliance	Average Wattage	Earnings per Annum
Irons	525	$6.00
Toasters	450	3.50
Grills	600	4.50
Chafing dishes	600	1.50
Percolators	450	3.50
Samovars	450	2.00
Water heaters (lamp socket)	450	1.50
Water heaters (over 650 watts)	2,500	50.00
Milk warmers	440	3.00
Sterilizers	450	6.00
Heating pads	50	1.00
Radiators (lamp socket)	600	5.50
Radiators (1,000 watts)	*1,000	9.00
Radiators (2,000 watts)	*2,000	12.00
Radiators (3,000 watts)	*3,000	15.00
Vibrators and hair driers	50	1.00
Curling iron	20	1.00
Sewing machines	75	1.50
Lamp socket motors	100	1.00
Vacuum cleaners	160	2.75
Washing machines	175	2.50
Portable lamps	50	6.00
Ranges	*5,500	55.00
Ovens	600	12.00
Fans	60	1.50
Small stoves	500	2.00
Dishwashers	100	3.00
Fireless cookers	660	12.00
Tailors' irons	850	25.00
Irons	3,000	15.00
Glue pots	300	7.00
Auto radiators	150	1.50
Soldering irons	200	8.00
Waffle irons	600	2.50
Domestic refrigerating machines	*300	30.00

*Based on average rate of 4 cents.
The above list is based on estimates presented by commercial men of large central station companies.

TABLE I—ANNUAL REVENUE AND DEMANDS OF VARIOUS ELECTRICAL APPLIANCES

Appliance	Maximum Demand in Watts	Annual Kw.-Hr. Consumption	Equivalent Hours Use of Demand	Annual Load Factor in per Cent of Max. Demand per Cent	Rate	Annual Revenue	Annual Revenue per Kw. Connected
Washer	300	20	66	0.75	$0.084	$1.68	$5.60
Grill	500	34	68	0.78	.084	2.85	5.70
Toaster	500	37.5	75	0.85	.084	3.15	6.30
Range	5,000	1,500	300	3.4	.0325	48.75	9.75
Iron	575	67	116	1.3	.084	5.62	9.79
Percolator	400	42	105	1.2	.084	4.03	10.07
Cleaner	170	25	147	1.7	.084	2.10	12.35
Radiator	600	96	160	1.8	.084	8.06	13.43
Fan	40	31	775	8.8	.084	2.60	65.00
Refrigeration	300	864	2,880	33.0	.0325	28.08	93.60

$0.084 is assumed to be the average lighting rate throughout the United States and $0.0325 the average cooking rate. The refrigerating machine, owing to its high load factor, is assumed to earn the same rate as the range.

It is apparent from the above data that the domestic refrigerating machine produces more revenue per kilowatt of demand than any domestic appliance served by a lighting company, and should, therefore receive the favorable attention of the electrical industry and particularly the attention of the central stations.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

The Oak Grove High-Head-Turbine Development of the Portland Electric Power Company.—ELY C. HUTCHINSON.—This illustrated paper describes a recently installed 35,000-hp. vertical Pelton turbine of the Francis type, operating under a head of 860 ft., and its controlling devices. In addition to giving numerous constructional details regarding various hydraulic elements of the plant, with reasons for their adoption, it briefly traces the history of high-head developments in the West and explains the relation of the new plant to the remainder of the system of which it is a member.—*Mechanical Engineering*, June, 1925.

Gas Turbines.—LIONEL S. MARKS and M. DANILOV. — An abstract of this paper may be found in the ELECTRICAL WORLD report of the New York meeting of the A.S.M.E., December 13, 1924, on page 1263.—*Mechanical Engineering*, June, 1925.

Asynchronous Generator Plant.—V. GENKIN.—A small manufacturing concern in France has three individual plants, located about 800 ft. apart along the same river. In each of these plants is located a water turbine of about 50 hp., and by means of a mechanical steel rope transmission, installed between pulley towers, these three plants have been interconnected to exchange power as needed. Recently this mechanical transmission system was replaced by electric transmission; but to simplify operation as much as possible, one synchronous generator was installed in one of the plants, while asynchronous machines are operated in the two other stations. Over a three-phase line, connecting these three establishments, any desired power exchange can be obtained with simplest means and without synchronization.—*Revue Générale de l'Electricité*, June 27, 1925.

High-Back-Pressure Turbines as Applied to Existing Stations. — HANS DAHLSTRAND. — Stations containing 10,000-kw. units at pressures of 250 to 160 lb. may be improved from about 18 to 30 per cent of present thermal unit efficiency by the application of high-back-pressure turbines for 700-deg. F. steam, exhausting into the present prime movers. A similar gain of 16 to 24 per cent may be possible where 30,000-kw. units are installed. Thermodynamic data are given by the author. Referring to temperature limitations, one of the charts shows the tensile strength of several metals at high temperatures, including one special alloy that holds a nearly constant value up to 1,100 deg. F. — *Power*, June 2, 1925.

Standard Unit of Wood Refuse.—The adoption of a standard for wood refuse to be used for fuel is advocated and specifications for such a standard are proposed, namely, 200 cu.ft., weighing 3,500 lb., containing 40 per cent moisture and having an available heat per pound of wet fuel as shipped of 4,760 B.t.u. The author mentions four correct methods of stating the heat values of wet fuel, as follows: (1) The inherent heat per pound of dry fuel; (2) the inherent heat per pound of wet fuel; (3) available heat per pound of wet fuel, and (4) available heat per pound of dry fuel. The suggested standard is based on a total heat per pound dry of 8,800 B.t.u., hence a total of 5,280 per pound wet at 40 per cent moisture and an available heat of 4,760 B.t.u. A method for applying the several correction factors for evaluating a sample as received in terms of the standard is explained.—*Power Plant Engineering*, May 1, 1925.

Generation, Control, Switching and Protection

Testing Steam Engines by the Heat Balance Method.—EUGENE OGUR.—The writer has developed a method whereby the water rate of an engine exhausting into a jet condenser may be determined from a single set of instantaneous readings on the incoming steam, the condenser intake and discharge and the load. The method is explained with the aid of an illustrative problem, certain alignment charts which are employed being published.—*Power Plant Engineering*, June 1, 1925.

Automatic Network Relay.—JOHN S. PARSONS.—The successful operation of a system of transformers in parallel on both primary and secondary sides, in conjunction with switches which will protect the transformers and at the same time keep them in circuit during all normal operating conditions, requires a relay that will disconnect on reversed current and reconnect when the conditions are again right. The present article describes the construction, connections and functioning of such a relay. Characteristic curves show the voltage and current conditions, as to both magnitude and phase-angle, to which it will respond.—*Electric Journal*, July, 1925.

Transmission, Substations and Distribution

Automatic Stations and Substations.—The entire issue is devoted to various aspects of automatic operation. Descriptions are given of hydro-electric stations, railway, lighting and industrial substations, synchronous condensers and converters—all automatically operated—and supervisory systems. In addition there is a three-page bibliography of the subject for the years 1921-1925.—*General Electric Review*, June, 1925.

Two-Phase to Six-Phase Transformer Connection of One Hundred per Cent Apparatus Economy.—A. BOYAJIAN.—An abstract of this paper may be found in the report of the Saratoga Springs convention of the A. I. E. E., in the ELECTRICAL WORLD, July 4, 1925, on page 19.—*Journal of the A.I.E.E.*, June, 1925.

Flash-Over on Insulators.—E. MARX.—In this article the author reports the results of a great many tests made on commercial high-voltage insulators with various kinds of currents. Investigations were made with direct-current, 50-cycle alternating current, 30,000-cycle current and impulse current. The flash-over voltage of a given porcelain insulator is decidedly different for these various currents. For impulse currents the flash-over lies higher, for high frequent voltages it is lower than for commercial frequency. For smooth surface supporting insulators, such as used for high-voltage indoor bus supports, the flash-over for high frequency is about one-third of the 50-cycle value. The direct current flash-over is higher than the commercial frequency alternating current flash-over. Impulse flash and direct current flash depend somewhat on the polarity applied. Rain decreases the alternating current and direct current flash-overs considerably, while it increases the high frequency value. The cause of this may be the equalization of the surface charges by the rain water. The great variance on the electric strength of porcelains with different current characteristics makes it desirable to conduct all fundamental investigations of these problems with all four of the above mentioned types of electric currents. — *Elektrotechnische Zeitschrift*, June 11, 1925.

Units, Measurements and Instruments

150,000-*Volt Cable Tests.* — A. M. TAYLOR.—Tests on a cable made according to the author's "hexaphase" or "compensated three-phase" system, to which reference has recently been made in the Digest, are reported.—*Electrician (England)*, June 5, 1925.

The Ballast Resistor in Practice.—H. A. JONES.—A type of resistance used extensively in industrial circuits to maintain a constant current, notwithstanding variations in applied voltage, is known as a "ballast resistor" or "Nernst Ballast." It consists of a pure iron wire in hydrogen. The author analyzes the behavior of this type of resistor and deduces certain mathematical conditions that must be fulfilled. Among the charts are the resistance curves of several metals for temperatures up to 1,400 deg. absolute and curves showing the exponents of the absolute temperature with which the resistances increase as the temperature rises. Experimentally observed volt-ampere curves are also given. It is shown both theoretically and experimentally that certain combinations of metal and hydrogen pressure will not at any temperature act as a ballast resistance.—*General Electric Review*, May, 1925.

Wave-Form Analysis on Rectified Circuits.—L. B. W. JOLLEY.—Equations are deduced for the form of various waves on the assumption of ideal rectification. The cases treated are single-phase, two-phase and polyphase in general. A table for cases up to eighteen phases gives root mean square value, mean value, form factor, amplitude of *n*th harmonic, area under one loop and several ratios connecting these quanti-

ties. A special case is that of the wave from a vibrating reed or neon tube, where the voltage rises to a certain magnitude before current flows and the current is cut off before it has fallen to zero.—*Journal of I. E. E. (England)*, June, 1925.

Motors and Control

Motor Performance on Combined Secondary Networks.—A. P. FUGILL.—With a combined low-voltage secondary network both single-phase lighting and three-phase power load are supplied from the same mains. The lighting load is connected from line to neutral; the voltage ratio between lighting and motor loads is therefore 1 to $\sqrt{3}$. It follows that either the lighting voltage must be raised above the customary 115 or the motor voltage reduced below the usual 220. Assuming successively 125, 120, and 115 volts for the lighting, the performance of standard 220-volt motors at the corresponding voltages is investigated. The results are shown in the form of the usual characteristic curves, suitably modified for voltages 5 and 10 per cent below normal.—*Electric Journal*, July, 1925.

The Pulling into Step of a Synchronous Induction Motor.—In an earlier issue of the Digest reference was made to a paper under this title in the February, 1925, *Journal* of the I. E. E. by H. Cotton. A criticism by L. H. A. Carr, with the author's reply, is now published.—*Journal of I. E. E. (England)*, June, 1925.

Self-Excited Synchronous Motors.—J. K. KOSTKO.—In this paper an outline of the general theory of self-excited synchronous motors is given. The study is made on the basis of the current locus, the treatment being mathematical in form. A bibliography is appended.—*Journal of A. I. E. E.*, June, 1925.

Heat Applications and Material Handling

Electricity in Mines.—E. IVOR DAVID.—As fifty pages are devoted to this paper and its discussion only a very brief indication can be given of the material presented, which includes a considerable quantity of data based on experience in British coal mining. The general problem of power production is first taken up and attention is called to the essential differences between a colliery power plant and a normal power plant. Among these is the lower grade of fuel used; another is the question of the economical utilization of coke-oven gas. In the latter connection the use of gas-fired boilers is stated to be the best commercial proposition in most cases, as is indicated in the accompanying table, in which costs are expressed as percentages of the cost per electrical unit in the coal-fired station. Under the head of power consumption, slip-ring induction motors are advocated for pumping, at any rate above 150 hp., and synchronous motors for driving the ventilating fans. As the latter are usually started under load a high synchronizing torque is needed and cylindrical-type rotors are used. In gassy seams there is a demand for compressed air as a working medium. The compressors then constitute the largest element of the load. Starting curves are given, showing that slightly more than full-load current is taken at the start and when changing over to full voltage if a modern salient-pole synchronous motor is used for this purpose. Its high efficiency and the improvement it makes possible in the total power factor recommend it. Comparative figures for this type of compressor and a large steam-turbine compressor under specified conditions are also given, and show 11.2 per cent less steam consumption for the latter. For the hoists the relative advantages of alternating-current and Ward-Leonard control are discussed. Finally, results are given of the progressive conversion of several mines from steam to electric drive, also the effect of supplying compressed-air power from a central station similarly to electric power.—*Journal of the I. E. E. (England)*, June, 1925.

	Old Gas Engines	New Gas Engines	Gas-Fired Boilers	Coal-Fired Boilers
Wages	16.25	12.95	8.78	8.78
Fuel	41.8	34.4	41.3	46.18
Stores and other charges	23.0	21.8	10.1	10.1
Repairs and renewals not included in stores	15.1	7.8	3.74	3.74
Capital charges	21.8	31.2	31.2	31.2
Expressed as percentage of coal-fired boiler	117.95	108.15	95.12	100.00
Station thermodynamic efficiency, per cent	19.05	24.0	19.35	16.35

Telegraphy, Telephony, Radio and Signals

Stereo-Accoustic Sound Reproduction.—E. MEYER.—Tests which date back to 1912 established the fact that telephonic reception of orchestras, large choruses and theatrical productions becomes much more lifelike when transmitted by two microphones over two lines to a left ear and a right ear receiver. Such an arrangement is a complete analogon to plastical vision with the aid of a stereoscope, where the mission depth in a photograph is introduced optically by bi-ocular vision. The article goes into considerable detail of the theory of this problem. The same principle can be applied to great advantage in submarine noise detectors. Tests are being made at present to adapt this valuable principle to radio broadcasting.—*Elektrotechnische Zeitschrift*, May 28, 1925.

Echo Suppressors for Long Telephone Circuits.—A. B. CLARK and R. C. MATHES.—This paper was presented at the spring convention of the A. I. E. E. at St. Louis, Mo. An abstract will be found in the ELECTRICAL WORLD, April 25, 1925.—*Journal of the A. I. E. E.*, June, 1925.

Filter Condensers.—R. E. MARBURY.—Some of the problems involved in the design of high-voltage direct-current condensers are pointed out. Such condensers are used in filter circuits to obtain smooth unidirectional high voltage from tube rectifiers for oscillators in radio transmission; in addition they find application with the Cottrell precipitation process, insulation testing, surge-producing devices for test purposes, percussive welding, etc.—*Electric Journal*, July, 1925.

Traction

Catenary Construction and Power Distribution on the Illinois Central.—Attention is called to certain features in the Chicago terminal area that are new in American railway electrification. Among these is the use of large mercury vapor rectifiers, two of 1,500 kw. and two of 3,000-kw. rating, which are apparently to be operated in parallel with the eleven 3,000-kw. converters, all of this equipment being housed in seven substations. Such use of large rectifiers has a precedent in European practice, but is new in this country. The catenary system, described in detail, also embodies novel features, one of them being a double contact wire. The two members are hung from an auxiliary messenger cable by staggered clips; the purpose of the arrangement is to eliminate "hardness" of contact as far as possible.—*Electric Traction*, May, 1925.

Norfolk & Western Completes Train Control.—D. W. RICHARDS.—The recently installed three-speed continuous inductive train control system on the 108-mile single-track division of the N. & W. between Hagerstown, Md., and Shenandoah, Va., is described. Reasons leading to the choice of a particular system are given, and its functioning is explained with the aid of circuit diagrams and views.—*Railway Age*, May 30, 1925.

Miscellaneous

The Electrification of the Irish Free State.—A plan has been proposed by the Siemens-Schuckert Company, of which the substance is given in a rather long abstract that involves the control of the River Shannon and the initial installation of two 30,000-hp. turbines and one of 15,000 hp., with a later full development by the addition of three 30,000-hp. units. A 110,000-volt double-circuit busbar 180 km. long is to extend through the middle of the country to Dublin, with a branch 93 km. long to Cork. In the partial development provision is made for about 1,885 km. of 35-kv. network and a 10-kv. network of nearly equal length. The total estimated cost of the partial development, including an allowance of 15 per cent for interest during construction, is somewhat under $25,000,000, and of the full development somewhat under $35,000,000. The salient features are set forth with the aid of maps, profiles, and diagrams of protective schemes for the very extensive electrical system. The criticisms directed against the plan receive considerable attention. It is questioned whether the proposed method is the most economical way to provide the country with adequate power; objection is also raised to the plan of having a population of 3,100,000 in a region 270 miles by 160 miles dependent on a single station.—*Engineering (England)*, May 29, June 5, 12, 1925.

News of the Industry

Expansion in Wisconsin

Utilities Plan New Stations and Transmission Lines—1,200 Lb. Steam Pressure May Be Used

CONSTRUCTION programs have been announced by two of Wisconsin's largest utility companies which include the construction of two large steam stations and two long transmission lines.

The Milwaukee Electric Railway & Light Company, which is controlled by the North American Company, is planning the construction of a generating station near Green Bay at a cost of $2,000,000 which would use pulverized fuel combustion equipment and a steam pressure of 1,200 lb. Experimental equipment using this pressure is now being installed in the new Weymouth station of the Edison Illuminating Company of Boston. The company will also add two additional generating units to its Lakeside station and will connect the Lakeside station, the new Green Bay station, and the hydro-electric plants of the Peninsula Power Company near Iron Mountain, Michigan, by a 250-mile, 132,000-volt, steel-tower transmission line. The Wisconsin Gas & Electric Company, another subsidiary of the North American Company, will share in the construction and use of the new transmission line.

G. B. Way, vice-president and general manager of the Milwaukee Electric Railway & Light Company said in regard to the program: "This program will mean that we can market in Milwaukee and the Fox River Valley the surplus energy of a dozen or more hydro-electric plants when the northern rivers run high and deliver low cost steam electric power to the northern district when its rivers run low. This will be a permanent saving of water power now wasted and of coal now burned for all of eastern Wisconsin.

"The new steam plant of Green Bay will be modeled after the high pressure generating additions now being designed for installation in the Lakeside plant—meaning that powdered fuel will be used. This type of plant can only be efficiently constructed in connection with another large plant or system having a minimum continuous steam load not interrupted by water power fluctuations and about equal in size to the full load capacity of the high pressure station."

BYLLESBY PLANS CONSTRUCTION

H. M. Byllesby & Company, who recently purchased the properties of the Wisconsin Public Service Corporation in Wisconsin and Michigan, announce that they will carry out the original improvement and expansion plans which were in progress at the time the deal was closed. These plans were to include the erection of a large steam-generating plant and the building of a central office and administration building in Green Bay.

It is reported, however, that the Byllesby company plans to build a station of 200,000 kw. capacity instead of one of 100,000 kw. as originally planned. The location of Green Bay on Lake Michigan is unusually favorable for cheap transportation of coal over the Great Lakes, and in consequence the proposed steam station would be able to generate power efficiently enough to work with the hydro-electric plants in supplying the system.

It is also said that a survey is to be made with a view to constructing a tranmission line across the north central part of Wisconsin to connect with the Northern States Power Company, which is also owned by the Byllesby company. Such a line would cut through the territory of the Wisconsin Valley Electric Company in some places, but it is apparently believed that satisfactory arrangements to regulate this situation could be made between the two companies and that the development made possible along the line and other advantages of interconnection would justify the project.

The new station and administration building in Green Bay will probably involve an initial cost of close to $2,500,000.

Moccasin Plant Again in Service

Faulty Handling of Valve Causes Water Hammer Which Ruptured Penstocks — Repairs Made and Two Units in Operation July 31, Additional Two Units in Service August 12

REPORTS from the Moccasin power house indicate that two of the 20,000-kva. units would on July 31 be supplying power to the Pacific Gas & Electric Company, under the contract made with the city, and it is hoped that the other two similar units will be ready by August 12.

Repairs to the penstocks leading to the first two units were completed on July 23 and water was turned into them for a test. A small leak developed in one of the lines near the surge chamber, however, and the water was again cleared out. Final repairs were completed on July 28 and after a three-day drying-out period it was expected to put the two machines in operation. The total damage is placed by the city engineer's office at $25,000.

CAUSE OF FAILURE

During the interval of several weeks following the accident at the Moccasin power house of the city of San Francisco (see ELECTRICAL WORLD of July 11), which ruptured two penstocks and split a third, a representative of the ELECTRICAL WORLD has been able to gather sufficient information to determine with some degree of accuracy what actually happened and the cause of the water hammer which did the damage. The plant was in the final stages of construction and two of the four 20,000-kva. units were running in the process of preparing the plant to go on the line. A third unit which had been shut down temporarily to inspect a bearing was being prepared for starting.

The man who was sent to open a 36-in. hydraulically-operated gate valve at the power house end of the penstock failed to open the by-pass before operating the main valve. It seems that the hydraulic gate valve had not been properly timed and the result was that it opened in a matter of seconds, instead of some five minutes, as it should. With the sudden opening of this valve, water under a static head of 1,316 ft. rushed into the 50-ft. section of empty pipe between the gate valve and the water-wheel nozzle and set up water hammer. To a man in the power house near the machine being started the first indication of trouble was a sudden rush of water through this empty section of pipe. This was immediately followed by a series of terrific sledge-hammer blows which shook the whole power house.

The pointer on a recording pressure gage swung off the scale with each successive blow. The normal pressure under this head is about 500 lb. per square inch, and the scale of the instrument was 850 lb. At the same time the hand on an indicating pressure gage was observed to swing backward and forward against the stop pins. This instrument had a full scale reading of 1,250 lb., indicating that the pressure rise was well over 100 per cent normal after making liberal allowance for the overswing of the needle. A few of the hammer blows served to cause a rupture about 1,000 ft. up the penstock line to the machine being started in a section of 66-in. lap-welded steel pipe.

After the initial rush of water into the empty pipe the succeeding excessive pressure rises were caused by the pressure wave traveling up the penstock to the surge chamber and being reflected back by the high inertia of the column of water in the surge chamber. This continued until the first break relieved the excessive pressure. Some twenty or thirty minutes later a second line to one of the other units, which had been so weakened by the water hammer as to be on the point of breaking, ruptured from the normal surges in the penstock resulting from the shutting down of the unit on this line. This break occurred at about the same distance from the power house

as the first, in a section of 66-in. pipe also, which was in no way connected with the first penstock that broke, except through a short section of pipe leading from the surge chamber. The third break was a 6-in. split of little importance in one of the other penstocks.

At this plant two 104-in. riveted steel pipes lead out of the surge chamber, branching after a short distance into two 98-in. riveted steel pipes, making four penstocks, one for each of the four units in the plant. A little further down the slope the diameter reduces to 66 in. and the pipe changes to lap-welded steel. A short distance from the power house the diameter is reduced to 54 in., and just outside of the power house each of these 54-in. pipes branches into two 36-in. pipes, which lead to the double overhung water wheels. In each of these 36-in. pipes there is located a hydraulically operated gate valve. It was the opening of one of these valves that started the trouble.

An unnecessary amount of damage was done to the power house by water rushing down the hillside because the control lines to the butterfly valves at the upper end of the penstocks had not been connected up. The valves had been arranged for temporary operation with an air drill, but unfortunately before they could be closed it was necessary to start up the camp air compressor and send a man to the top of the penstocks to perform the operation. This took one hour and twenty minutes and before the valve in the penstock which first broke was closed a large quantity of water had rushed down the hillside, carrying dirt, trees and other débris. A section of railroad and a section of the tram line along the penstock were washed out in addition to filling the switch yard and power house basement with mud, water and trash.

The generators extend several feet below the power house floor and the lower portion of the windings as well as the field rheostats, oil pumps and other auxiliary equipment were completely submerged. In order to get the water out of the power house as quickly as possible small holes were dynamited in the lower portion of the tailrace wall.

Norfolk & Western to Continue Electrification

If its lease of the Virginian Railway is approved by the Interstate Commerce Commission the Norfolk & Western Railway Company will pool its and the Virginian's electrical operations, thereby probably suspending for the time being completion of the projected electrification of the Virginian eastward to tidewater to concentrate upon its own electrification work to the west. There have been rumors that if the lease was approved the Virginian's uncompleted electrification would not be carried out, but it is said now that plans are being worked out for a much larger project which would eventually take in both roads.

It is reported that the plans, provided aproval of the lease is forthcoming, will enable the Norfolk & Western to continue its work of electrification over heavy grades westward from points in West Virginia to Williamson, near the Kentucky border in West Virginia. The 60-mile line from Bluefield to Iager has already been electrified and is in operation. The Norfolk & Western desires to extend the electric route from Iager to Williamson, and foundations for the electrification of this part of the railroad are expected to be completed this year.

The Virginian's electrification work was started two years ago and involves a total expenditure of $18,000,000. The initial part of the project, extending from Mullens to Princeton, W. Va., has practically been completed. Construction work on the route from Princeton to Roanoke had well advanced prior to the announcement of the leasing of the Virginian by the Norfolk & Western, but reports say a suspension of this work is contemplated and already some workers have been laid off. This is the stretch presumably being held up by the Norfolk & Western pending the Interstate Commerce Commission's approval of the lease.

California Commission Upheld by Court

Sustaining the contention of the California Railroad Commission in the action brought against it by the Southern Sierras Power Company, Judge Paul McCormick of the Federal District Court for the Southern District of California on July 16 granted the motion of the commission's attorneys to dismiss the suit brought against it by the power company. The suit which questioned the matter of the commission's jurisdiction and operation represented the most important attack upon the Railroad Commission made during the last few years.

The company, which operates in the eastern and southeastern portions of the state, asked the federal court to annul two orders of the Railroad Commission, one of which fixed rates to be charged for electric service upon its system, the other denied an application for temporary rate increases. The court was asked to enjoin the Railroad Commission from enforcing the collection of the present schedule of rates upon this system and also to enjoin the Railroad Commission and all other persons from interfering in any way with the collection of a proposed new schedule of rates 10 per cent higher than the existing rates, save in certain territory in and around San Bernardino, where this company operates in competition with the Southern California Edison Company.

The Railroad Commission, through its attorneys, moved that this complaint be dismissed upon the ground, among other things, that the federal court did not possess jurisdiction to grant the relief asked in this complaint, and upon the further ground that the plaintiff should exhaust its remedies under the state law before going to the federal court. The commission also took the position that since the utility had itself voluntarily reduced a large number of the rates fixed in the commission's order, this company could not properly attack these rates in the federal court.

Japan Said to Lead World in Wired Homes

Burnett Walker, vice-president of the Guaranty Company of New York, on his return from an extended trip, including Japan, where he spent several weeks investigating the electrical industry and negotiating for financing in America, commented on the extensive use of electricity in Japan and particularly on the large proportion of homes which are wired. He said in part:

"The visitor to Japan is struck immediately by the extensive use of electricity. There is today probably a larger proportion of houses lighted by electricity in Japan than in any other country in the world, not even excepting the United States, and virtually all large manufacturing establishments use electrically driven machinery.

"The total capital invested in 1923 in the Japanese electric enterprises, including privately owned electric railways, which frequently do a substantial power and light business, was substantially in excess of a billion dollars.

"That electricity is so generally used in Japan is the result in part of economic circumstances, most of the country being richer in water power than in coal or other fuel, although the Japanese people are adapting Western methods at an astounding rate.

"The electric power and light business as a public utility is almost as old in Japan as in any other country, having had its inception in 1887.

"It is interesting in Japan to find how many of the managerial staff and engineers have had training in American universities and in our big electrical companies. A large part of their machinery also has been purchased in this country."

"Customers' Dividend" Declared at Hartford

Owing to abnormally low expenses enjoyed during the past year, the directors of the Hartford (Conn.) Electric Light Company voted on Tuesday of this week to give every customer a 50 per cent discount on his October, 1925, bill, and covering the September to October service rendered. In announcing this unusual step, the directors pointed out that the above low expenses have been in part due to the absence of any expensive or major items of repairs and in part to the lowest coal price in recent years. The result has been earnings approximately 5 per cent more than required for interest, dividends and a moderate surplus for the year. The aggregate amount of the saving estimated to customers is $240,000. About 50,000 customers are now on the company's books. The announcement was made far enough in advance of the September period to encourage the experimental use of household appliances. To a representative of the ELECTRICAL WORLD President Samuel Ferguson stated that the possible temporary character of the favorable conditions resulting in low operating costs made it wiser to declare the 50 per cent reduction for one month than to make a permanent cut of 5 per cent in the rates. All classes of customers will benefit by the reduction.

Iowa Utilities Consolidating

Four Large Mergers of Power Companies This Year—Eight Municipal Plants May Be Sold

THERE have been four mergers of electric light and power utilities in Iowa in recent months which have caused widespread changes in the control of Iowa central stations.

The earliest of these mergers was the acquisition by the United Light & Power Company of Davenport of the Continental Gas & Electric Corporation, which operated the Iowa Service Company and Lee Electric Company in the southwestern part of the state. This was followed by the formation of the Iowa Railway & Light Corporation of Cedar Rapids, which will operate properties valued at about $35,000,000 in various parts of Iowa.

The United Gas Improvement Company of Philadelphia, which owns the Sioux City Gas & Electric Company, formed the Central Iowa Power & Light Company about six months ago and in June acquired the Iowa Light, Heat & Power Company. This gives the United Gas Improvement holdings in Iowa valued at about $75,000,000 and extending from Sioux City east across the state to within a short distance of the Mississippi River. The Central States Power & Light Corporation, recently formed, owns, among other properties in the Middle West, the Northeastern Iowa Power Company, operating several small utilities in northeastern Iowa.

CITIES MAY SELL MUNICIPAL PLANTS

Eight Iowa towns which have municipal plants are considering the sale of their plants to privately owned utilities, and in most of them special elections will be held on the question in August. Whiting, Moville, Schlesing, Soldier, Scarville, Ricketts and Seymour are the towns which have received offers for their stations and distributing systems. It is expected that most of them will be served from transmission lines if they decide to sell.

Committee to Standardize Water Power Rating

A joint technical committee is now being organized to bring about national uniformity in the methods of rating the water power of rivers, according to an announcement by the American Engineering Standards Committee.

At the instance of the Geological Survey the committee made an investigation, and found that many different groups were interested in bringing about national uniformity in the rating of rivers, including light and power companies, financial groups interested in power development, consulting engineers and federal authorities, such as the Federal Power Commission, Geological Survey and Reclamation Service. This investigation was carried out by a special investigating committee under the chairmanship of Charles A. Mead, and a questionnaire was sent to all interested technical and industrial groups.

The announcement calls attention to the fact that at the present time a given water-power development may be rated at 10,000, 20,000 or 40,000 hp. by different engineers, according to the point of view from which the work is done. The first figure might mean that the power is practically available all the time without provision of any storage basin; the second might mean that this power is available for a certain percentage of the time, and the last figure might indicate that under certain conditions, as for example if a storage reservoir were provided, the most effective use of the riverflow would be achieved when this rate was reached.

The subject was discussed at length at the World Power Conference in London in 1924, when it was recommended that the subject be taken up in the different countries and if possible reach an international agreement.

Southern Canada Power Completes New Plant

The Southern Canada Power Company has completed the installation of six 5,000-hp. units at Hemming's Falls near Drummondville, Quebec, and the formal opening will soon take place. The company has several new transmission lines nearly completed and will soon be supplying power to all the more important districts on the south side of the St. Lawrence by two separate lines, thereby minimizing the possibility of interruption and improving the service. The company has recently completed a substation at Richelieu connecting with the system of the Montreal Light, Heat & Power Company.

Federal Power Commission Considers Applications

Clark E. Jacoby and Eugene L. Williams, Interstate Building, Kansas City, Mo., on behalf of the Central Missouri Power & Water Company, have applied for a preliminary permit covering a power project on Current River near Van Buren. This application is in direct conflict with an application previously submitted by the Missouri Hydro-Electric Power Company and another submitted by John A. Shaffer. A hearing before the district engineer of the Corps of Engineers will be held at Doniphan, Mo., on August 26, at which questions involved in this proposed development will be considered. The proposal of Jacoby and Williams is to build a 64-ft. concrete dam 2 miles above Van Buren. The dam would measure 1,250 ft. on its crest and would create a reservoir with a capacity of 92,000 acre-feet. A second dam 140 ft. high and with 1,170 ft. of crest line would be built 17 miles above the lower dam and would create a dam of 550,000 acre-feet of storage capacity. The plan is to tie this development into another project on the Gasconade River.

The Washington Water Power Company of Spokane, Wash., has applied for a license for a project in Columbia River at Hayes Island. It is proposed to build one dam above the upper falls and another at the lower end of Hayes Island. This will make available 150,000 continuous horsepower and 80,000 secondary horsepower, it is estimated.

Charles A. Johnson of Lakeside,

Bringing Unit No. 1 Up to Speed at Pit River No. 3

P. M. Downing, vice-president of the Pacific Gas & Electric Company, and other officials and guests watching the first unit of the Pit River project being brought up to speed during the formal dedication ceremonies which took place on July 18. Miss Bernice Downing, editor of the Santa Clara *Journal*, is handling the control wheel.

Ariz., has applied for a preliminary permit covering a small development in Salt River, 20 miles north of Globe. He proposes to erect a concrete diversion dam 15 ft. high near Hess Creek. Five hundred second-feet of water is to be diverted through a 7-mile tunnel and ¼-mile of steel pressure pipe to a power house. The power is intended for use in the Globe and Miami mining districts.

The California-Oregon Power Company of San Francisco has applied for a license covering 3¼ miles of transmission line in Klamath County, Ore.

The Susquehanna Power Company has filed with the Federal Power Commission its property map covering its holdings in Maryland. The work is nearing completion on the Pennsylvania map. All of the information called for by the Federal Power Commission will have been provided when the Pennsylvania map is submitted.

A study is being conducted by the Federal Power Commission to establish the amount of the annual charge it would be reasonable to require for the use of the dam in the Ohio River at Louisville by the Louisville Hydro-Electric Company as reported in the ELECTRICAL WORLD of July 18. The charge in this instance cannot be based on comparable precedents. The Louisville project is unique in that it has no primary power. For this reason it may be necessary to arrive at some arbitrary figure which will not discourage the development and at the same time give the government an adequate return for the use of its structure.

Wisconsin Public Service Sale Upheld

Railroad Commission Gives Details of Purchase by Byllesby Company in Answer to Criticism of Governor and Commission—Purchase Price Is Held to Be Fair

THE Wisconsin Railroad Commission has published a statement made by it to Governor Blaine of Wisconsin in answer to criticism of the Governor and the commission caused by the recent sale of the Wisconsin Public Service Corporation to H. M. Byllesby & Company.

The commission's statement was based on conferences with Clement C. Smith, president of the Wisconsin Public Service Corporation; Halford Erickson, vice-president of the Byllesby Engineering & Management Corporation; Edwin S. Mack, a Milwaukee attorney, and John H. Roemer, general counsel for the Byllesby organization. It makes public the details of the purchase and shows that because of the nature of the transaction the commission had no jurisdiction, though it felt that the interests of the public were in no way jeopardized. The commission pointed out that it had no right to interfere with or control the sale of stock or property of a Wisconsin public utility to a corporation in another state.

COMMISSION WILL BE FAIR TO PUBLIC AND UTILITY

The report addressed to Governor Blaine by the commission said in part:

"The impression has been created that a burden will be thrown upon this territory because of engineering and management fees of the Byllesby interests. It is a custom of the Byllesby Engineering & Management Corporation to charge certain fees for supervision of operating and construction work. This commission has never had occasion to pass upon the reasonableness of those fees. It seems to us only fair to ask that judgment on this be delayed until the issue has been presented to the commission and that, for the present, it may be assumed that the commission will decide any such issue in a way that would be fair both to the public and to the utility."

"The common stock of the Wisconsin Public Service Corporation, with the exception of a few scattering shares, was sold to the Byllesby interest for $6,177,945. The par amount of stock is $2,650,000, but the balance sheet of the Wisconsin Public Service Corporation as of approximately the date of transfer shows a surplus of $1,255,000, a large part of which surplus ($535,000) exists because holders of the common stock did not take dividends, so that as far as the records of the company indicate, the $6,177,945 should be related not to the par amount of stock, but to that amount plus the surplus, or to approximately $3,900,000.

"In connection with this our attention has been called to the fact that since its organization in 1912 the Wisconsin Public Service Corporation has never paid a dividend upon its common stock. For a time no dividend was paid upon preferred stock and for one year the bond interest is stated to have been carried for the company. What earnings there were, which might have been available for common stock dividends, went back into the property. The extent of the profit made upon the sale of this common stock might be judged, not solely by a comparison of its face value with its selling price, but, in part at least, by the reasonable return on that common stock which has been foregone over a period of thirteen years. The sale price in comparison with $900,000 of stock and surplus, if it told the whole story, would represent a large percentage of increase in the cost of the property to the new stockholders over its cost as indicated by the balance sheet of the public service corporation. However, the property was taken subject to $10,807,000 of bonds and $783,000 of notes assumed. There was also $2,807,217 of preferred stock. The face amount of stocks, bonds, notes and surplus is $18,302,000. The increase in sale price of the stock over the face amount of stock and surplus is relatively small when related to the total capital structure of the company. The company's books show a property and plant of a value of a little over $20,000,000, and, in addition, it has other assets of more than $1,500,000. It appears, therefore, that the Byllesby people paid for the controlling interest in this property about $2,500,000 more than the book value of the equity acquired. This represents an increase of about 11 per cent above the book value of the total property.

"The commission has not had occasion to make complete inventories of all of the property involved in the Wisconsin Public Service Corporation. The Byllesby people made an appraisal as a basis to guide their own judgment in this purchase, which appraisal, we are informed, indicated a reproduction cost on the basis of the prices of the last two years of almost $25,000,000. Similar appraisal made by the Wisconsin Public Service Corporation indicated a reproduction cost of about $300,000 less than the appraisal of the Byllesby people.

"Both the Byllesby company and the public service corporation have developed a figure of so-called historical cost of $20,133,000. Both state that this is based on figures which the commission has used as to the value of portions of the property not including that at Oshkosh, and that for the Oshkosh property they used an appraisal developed by Byron T. Gifford. The $20,133,000 includes 10 per cent for going concern value, but we are informed that it is not based upon the high construction costs of the present time, except as such costs have actually been incurred."

Electrical Manufacturers Elect Section Officials

Some of the sections of the Associated Manufacturers of Electrical Supplies have held their annual election of section officials. A list of the section chairmen elected follows:

Laminated Phenolics Product Section: D. J. O'Connor, Formica Insulation Company, Cincinnati, Ohio.

Signaling Apparatus Section: G. K. Heyer, Western Electric Company, New York.

Radio Apparatus Section: G. A. Scoville, Stromberg-Carlson Manufacturing Company, Rochester, N. Y.

Attachment Plug Section: C. H. Van Amburg, General Electric Company, Bridgeport, Pa.

Outlet Box Section: H. G. Knoderer, General Electric Company, Bridgeport, Pa.

Non-Metallic Conduit Section: W. E. Sprackling-Tubular Woven Fabric Company, Pawtucket, R. I.

Armored Conductor and Flexible Conduit Section: A. J. Young, General Electric Company, Bridgeport, Pa.

Fuse Section: F. D. Masterson, Chase-Shawmut Company, Newburyport, Mass.

Panelboard and Switchboard Section: A. C. Streamer, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Lamp Receptacle and Socket Section: R. M. Eames, Bryant Electric Company, Bridgeport, Conn.

Rigid Conduit Section: C. E. Corrigan, National Metal Molding Company, Pittsburgh, Pa.

Vulcanized Fiber Section: C. C. Steck, Spaulding Fiber Company, Tonawanda, N. Y.

Briefer News

New Unit to Be Installed in Waukegan (Ill.) Plant.—The Allis-Chalmers Manufacturing Company has announced the receipt of an order for a new 50,000-kw. unit complete with a condenser for the Waukegan plant of the Public Service Company of Northern Illinois.

Statue Erected to John F. Stevens on the Continental Divide.—On July 21 the upper Mississippi Historical Expedition unveiled as one of its memorials to pioneers of the Northwest a statue of John F. Stevens, who was awarded the John Fritz medal this year. The honor was given as a recognition of the engineering genius which found a railway right-of-way through the Rocky Mountains at a lower altitude than any other northern route in the United States.

New Orleans Electrical League Favors Private Operation of Muscle Shoals.—At its meeting on July 20 the Electrical League of New Orleans passed a resolution in which the lease of Muscle Shoals to some privately owned company was advocated. A copy of the resolution will be sent to all Louisiana Representatives in Congress.

Fifth Unit at Cameron Falls (Ont.) in August.—It has been announced that the installation of the fifth 12,500-hp. unit at the Cameron Falls plant of the Ontario Hydro-Electric Commission will be completed about the middle of August. The sixth and final unit will be in commission in October and will give a plant capacity of 75,000 hp. The Cameron Falls development is on the Nipigon River and feeds into the 110,000-volt transmission system of the Thunder Bay district.

New Operating Company Formed in Texas.—The Lone Star State Power Company of San Antonio has been incorporated with a capital stock of $10,000. It is stated that the capital stock is nominal and that the company has already purchased the electric light and power plants of Floresville, Kyle, Buda, Round Rock, Hutto, Burnet and Bertram at a total cost of $100,000. The incorporators are Jordan Fowler, James A. Harley and John W. Gaines, all of San Antonio.

Chats Falls Power Site to Be Developed Soon.—The early development of the Quebec side of the Chats Falls, situated about 30 miles west of Ottawa, Canada, is now assured. The Pontiac Mining Company of Ottawa, Ltd., has sold its hydro property at the Chats Falls to the Kingdon Mining, Smelting & Manufacturing Company, Ltd., of Galetta, Ontario, a large producer of lead. The Kingdon company has also purchased, from Louis Simpson, property at the same site which is required for the water power development, and, having secured the necessary permission and approval of its plans from the provincial government, expects to commence development at an early date. Plans of development as proposed will provide 60,000 hp. Of this amount 20,000 hp. would be required for industrial enterprises of the company, leaving 40,000 hp. available for other use.

Texas Company to Extend Lines.—An extension of the transmission system of the West Texas Utilities Company from Ballinger to Menard, a distance of 70 miles, will be made as a result of the company's purchase of the plant of the Menard Light & Power Company. It is stated that the transmission line and other improvements will cost $150,000. The line will run via Paint Rock and Eden. The local plant at Menard will continue in operation.

Municipal Plant at Meigs (Ga.) Goes to Georgia-Alabama Power.—The Georgia-Alabama Power Company of Albany, Ga., has purchased the municipally owned plant at Meigs, Ga., and will build a five-mile extension from its transmission lines at Pelham, Ga., to serve Meigs. It is understood that the plant at Meigs will not be dismantled, but will be maintained as a stand-by station.

Cushman Development Progressing Favorably.—In the opinion of Commissioner of Light Ira S. Davisson of Tacoma, Wash., the Cushman power project is progressing at a pace that will make power available by January 1, 1926, which was the original date set for completion. The big dam in the Skokomish River, which is being poured in three sections across the river, is more than 120 ft. above bedrock on the lower side and more than 150 ft. on the higher side. Transmission line construction has proceeded to the point of stringing wires.

Bloomfield (Neb.) Continues Plan for Municipal Plant.—The City Council of Bloomfield, Neb., is proceeding with plans for the installation of a municipal light and power plant authorized with a $50,000 bond issue, and although representatives of the Tri-State Utilities Company conferred with the Council in an attempt to iron out all differences nothing was accomplished. The city has indicated a willingness to purchase the distribution system, but there have been no indications of the company desiring to sell.

Aluminum Company's Plans for Canadian Expansion Approved.—The proposal of the Aluminum Company of America to merge with the Canadian Power & Manufacturing Company was approved by stockholders today. It is proposed to build a huge power and manufacturing plant on the Saguenay River in Canada. J. B. Duke and I. E. Davis, president of the Aluminum Company, recently acquired an 800,000-hp. site at Chute à Caron in addition to the 360,000-hp. Ile Maligne site now under construction (see ELECTRICAL WORLD, July 25, page 183). The decision of the aluminum company to build at the Saguenay River site will mean a ready market for all the power to be developed. The combined industrial and power project will involve the expenditure of approximately $100,000,000, it is said, and another special meeting of stockholders will be called soon to create a bond issue to provide funds for the new development. It was stated officially by the Aluminum Company of America that the new Canadian development would in no way affect the operations now being carried on in this country.

Indiana Utility to Purchase Two Small Plants.—The Lake Shore Power Company, which operates electrical utility properties in the extreme northeast part of Indiana, has filed applications with the Indiana Public Service Commission asking for authority to buy and take over two utility properties and to issue stocks equal to the purchase price. The properties to be bought are the Hamilton Mill Company, Steuben County, at a purchase price of $18,000, and the Metz Light & Power Company, Metz, Ind., at a price of $3,000. The stocks to be sold amount to $21,000.

Power Plant in France Wrecked by Storm.—On July 22 the electric power plant at La Picadere, on the L'One River below the Peyresourde Pass of the Pyrenees Mountains, was entirely wrecked by a storm of cyclonic fury which swept through France. The entire plant was swept into the river when the penstocks broke and two operators in the plant at the time were killed. There were nine deaths at Luchon, which was supplied with energy by the La Picadere plant, and the town's water system reservoir near the power plant was also swept away.

Missouri Power & Light Sells Its Oklahoma Properties.—The board of directors of the Missouri Power & Light Company, Mexico, Mo., on July 24 authorized the sale of its Oklahoma property for $4,615,000. The plant at Waurika, Okla., goes to the Southwest Utility Company and the properties in Durant and Ardmore to the Oklahoma Gas & Electric Company. The stockholders of the Missouri Power & Light Company voted to issue $1,200,000 of preferred stock.

Wynooche River Rights Still Unsettled.—Rehearing in the matter of the proposed cancellation of the water power rights of the city of Aberdeen, Wash., on the Wynooche River was recently held before R. K. Tiffany, state supervisor of hydraulics, at Olympia, Wash. The city presented evidence of the progress being made by the city to maintain its rights, which it gained under a permit transferred to the city by J. E. Malinowski. The hearing followed a notice sent by former Supervisor Marvin Chase, ordering the city to appear and show cause why its permit should not be canceled for failure to proceed with development as required by permit. The city has applied for extension of its permit and the supervisor has taken the new evidence under consideration. Active opposition to development of the Wynooche by the city comes from the Grays Harbor Rail-

way & Light Company, which is seeking to obtain all available water on the Wynooche for hydro-electric power development. The company has filed with the State Department its agreement in case it acquired the power rights to permit the city to take such water as necessary in order to provide for an increase to its present municipal water supply.

Consolidation in Shenandoah Valley of Virginia.—It is reported that before September 1 a New York syndicate will purchase the properties of the Weyers Cave Light & Power Company, the Valley Light & Power Company, F. A. Shank & Company, T. A. Andrick and two plants owned by J. T. Triplett. These plants serve the towns in the central Shenandoah Valley between Staunton and Strasburg with the exception of the Shenandoah and Luray districts. It is estimated that an expenditure of about $800,000 will be required to purchase the stock of these properties.

Paris Utilities May Be Financed in This Country.—It is reported that J. E. Aldred, of J. E. Aldred & Company, and representatives of other New York investment bankers are now in Paris negotiating with the French authorities in regard to new financing for the Union d'Electricité and the Paris Gas Company, which serve the French capital with electricity and gas respectively. The utilities are owned by the French Government and leased to management companies, and while the bankers cannot obtain control, they can probably purchase the equity not owned by the government, which is substantial. This would be the first financing done in this country for the Paris utilities and it is said that the total amount may exceed $25,000,000.

New Transmission Lines Completed in Illinois.—The Illinois Power & Light Corporation has completed a 66,000-volt transmission line between Springfield and Decatur, a distance of 43 miles. The line is of the square-base, steel-tower, double-circuit type, with 70-ft. steel towers at intervals of 660 ft. and is equipped with the most modern wireless telephonic equipment. It forms another link in the company's network of lines over central Illinois that will soon be extended from Decatur east to Danville and north to Bloomington. The Illinois Power & Light Corporation also recently placed in service a steel-tower transmission line from Keokuk to Monmouth that will be extended soon to Galesburg and Galva.

Canadian Light & Power Company Cannot Produce Amount Estimated.—A report on the Canadian Light & Power Company's condition, sent to bondholders recently by the directors of the company, gives the results of an examination made of the plant at Fort Timothee, near Montreal, by F. Swenningston, chief engineer of the Shawinigan Water & Power Company. This report states that the capacity of the plant is 17,000 hp. in summer and 12,750 hp. in winter, instead of its designed capacity of 20,000 hp. It further states that the limit of the capacity of the plant is fixed by the inadequate cross-section in two stretches of the canal above the plant and that the expenditure of $850,000 necessary to enlarge the canal, including a five-month shutdown of the plant, would not be justified by the $50,000 annual revenue which would be derived from the additional output. It is thought probable that the United Securities Company, which controls the company, will make some offer to bondholders to adjust the financial structure of the company, since for several years the company has not earned its bond interest or sinking fund requirements.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 4, page 50.]

International Association of Municipal Electricians—Hotel Statler, Detroit, Aug. 17-20. W. R. Arbuckle, Bayonne, N. J.

Wisconsin Utilities Association, Electric Section—Green Bay, Wis., Sept. 4-5.

Camp Co-operation V (local leagues)—Association Island, Henderson Harbor, N. Y., Sept. 8-12. (Society for Electrical Development, New York, is sponsor.)

New England Division, N. E. L. A.—Hotel Griswold, New London, Conn., Sept. 8-11. Miss O. A. Bursiel, 149 Tremont St., Boston.

Society for Electrical Development—Henderson Harbor, N. Y., Sept. 8-12. S. E. D., 522 Fifth Ave., New York.

Pennsylvania Electric Association—Bedford Springs, Pa., Sept. 9-12. Harold A. Buch, 212 Locust St., Harrisburg, Pa.

Pennsylvania State Association of Electrical Contractors and Dealers—Hotel Jermyn, Scranton, Sept. 10. M. G. Sellers, 1202 Locust St., Philadelphia.

Rocky Mountain Division, N. E. L. A.—Hotel Colorado, Glenwood Springs, Col., Sept. 14-17. O. A. Weller, 900 15th St., Denver.

Association of Iron and Steel Electrical Engineers—Benjamin Franklin Hotel, Philadelphia, Sept. 14-19. John F. Kelly, Empire Bldg., Pittsburgh.

Southeastern Geographic Division, N. E. L. A.—Birmingham, Sept. 15-18. E. T. O'Connell, Alabama Power Co., Birmingham.

American Institute of Electrical Engineers, Pacific Coast Section—Seattle, Sept. 15-17. P. L. Hutchinson, 33 West 39th St., New York.

Great Lakes Geographic Division, N. E. L. A.—French Lick Springs, Ind., Sept. 23-26. R. V. Prather, 305 Illinois Mine Workers' Bldg., Springfield, Ill.

Association of Electragists International—West Baden, Ind., Sept. 23-25. L. W. Davis, 15 W. 37th St., New York.

American Electrochemical Society—Chattanooga, Tenn., Sept. 24-26. Colin G. Fink, Columbia University, New York.

Empire State Gas and Electric Association—Lake Placid Club, N. Y., Oct. 1-2. C. H. B. Chapin, Grand Central Terminal, New York.

American Electric Railway Association—Atlantic City, N. J., Oct. 5-9. J. W. Welsh, 292 Madison Ave., New York.

National Association of Railway and Utilities Commissioners—Washington, D. C., Oct. 13-16. J. B. Walker, 270 Madison Ave., New York.

Electric Power Club—Briarcliff Manor, N. Y., Oct. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Association of Edison Electric Illuminating Companies—Hot Springs, Ark., Oct. 19-23. Preston Millar, 80th St. and East End Ave., New York.

Association of Railway Electrical Engineers—Hotel Sherman, Chicago, Oct. 20-24. J. A. Andrencetti, 413 C. & N. W. Terminal Station, Chicago.

American Welding Society—Annual fall convention, Boston, Oct. 21-23. M. M. Kelly, 29 West 39th St., New York.

Kansas Public Service Association—Topeka, Oct. 23-24. H. Lee Jones, Topeka, Kan.

Iowa State Association of Electrical Contractors and Dealers—Waterloo, Iowa, Oct. 27.

Binghamton (N. Y.) Company to Absorb Small Company.—The Binghampton Light, Heat & Power Company has petitioned the Public Service Commission for consent to merge with it the Afton-Windsor Light, Heat & Power Company, Inc. The Binghamton company acquired the entire capital stock of the other company last December, but has since been operating it as a separate company. The company proposes to construct a transmission line from Binghamton through the towns of Dickinson, Fenton, Kirkwood and Colesville, Broome County, to connect up with the lines of the Afton-Windsor company, and to operate the small hydro plant at Center, N. Y., as an auxiliary station.

Maritime Company Changes Hands.—The Maritime Electric Company, Ltd., operating plants in Frederickton and St. Stephen, N. B.; Calais, Me.; Charlottetown, P. E. I., and Bridgewater, N. S., has been acquired by Robert A. Pritchard and Kenneth T. Young, Boston, Mass., who have respectively been elected president and treasurer of the organization. About 3,000 kw. in generating plants is operated by the company in these widely scattered centers. President Pritchard stated to a representative of the ELECTRICAL WORLD this week that press dispatches to the effect that substantial expenditures for plant development are in early prospect are incorrect and that at present efforts will be devoted to co-ordinating the management of the company divisions and to extensions of the distribution systems.

Western United Authorizes Plant Extension.—A contract has been awarded by the Western United Gas & Electric Company to Stone & Webster, Inc., Boston, Mass., for the installation of a 20,000-kw. turbo-generator in its plant at Aurora, Ill. Two additional 1,000-hp. Stirling boilers with chain grate stokers are included in the contract. The entire forced draft system will be remodeled and new equipment will be installed. The boiler room substructure will be reconstructed, providing for ash tunnels and a fan room, and a skip hoist for ash handling will be erected adjacent to the railway tracks. Extensions to the coal-handling equipment will also be made and dredging operations will be carried out in the river to improve the circulating water supply. Electrical section extensions will provide for the new 20,000-kw. unit, with other improvements. In addition, 20 miles of 33,000-volt transmission line will be erected on wooden poles between Elgin and Glen Ellyn, Ill., with a low-tension substation at Glen Ellyn.

Men of the Industry

Dr. Dwight Joins M. I. T. Staff

Dr. Herbert Bristol Dwight, noted electrical engineer, has joined the professorial staff in the electrical engineering department of the Massachusetts Institute of Technology.

Dr. Dwight studied at the University of Toronto and McGill University and was graduated from the electrical engineering course of the latter in 1909. He entered the employ of the Canadian Westinghouse Company, where for years he has been in charge of the design of direct-current and synchronous alternating-current rotating machinery. His studies and experience in this employment have made him an authority on the design of rotating machinery over a wide range of characteristics. He has also given a great deal of interest to the development of power transmission and has planned important proposed projects. Dr. Dwight is the author of three books relating to power transmission and allied subjects, in addition to having published numerous scientific articles in the *Transactions* of the American Institute of Electrical Engineers and other journals relating to the theory of electric circuits, design of electric machinery and the transmission of electric power. In 1924 McGill University conferred upon him the degree of doctor of science.

The addition of Dr. Dwight brings to the staff of the institute an electrical engineer of high theoretical and practical attainments.

John F. Schurch was elected president of Manning, Maxwell & Moore, Inc., New York, at a meeting of the board of directors held July 1. Prior to his recent election as chief executive, Mr. Schurch had been a vice-president of the company since 1922.

G. W. Sherin, advertising manager of the American Bosch Magneto Corporation, has resigned, effective August 1. No announcement has been made as to his probable successor. Mr. Sherin has not disclosed his plans for the future, other than to state that he will take an extended vacation.

George E. Learnard, president of the International Combustion Engineering Corporation, and G. G. G. Hunter, controller of the company, returned from Europe July 25 aboard the Cunard liner *Aquitania.* Mr. Learnard reported a big boom in the corporation's European trade.

A. R. Gwinn has been appointed manager of the industrial department recently organized by the Central Illinois Public Service Company. The principal purpose of this department is to assist the industrial growth of all communities which the Central Illinois Public Service Company serves.

Fraser S. Keith, who has been affiliated with the Engineering Institute of Canada in an advisory capacity since his resignation as secretary last January, has severed his official connection with the institute. Mr. Keith had served for eight years as general secretary and was the editor and manager of the *Engineering Journal,* published by the institute, when he resigned to become manager of the department of development of the Shawinigan Water & Power Company, Montreal. A sterling silver tray was presented to Mr. Keith by the members of the council as a mark of esteem and appreciation.

C. S. Kennedy New President of North Central Division

C. S. Kennedy, who was elected president of the North Central Division of the National Electric Light Association at the annual convention held in Duluth, Minn., is a graduate of the school of electrical engineering of the University of Michigan, class of 1906. After

C. S. KENNEDY

graduation he entered upon his career in the electrical industry as an employee of the Westinghouse interests in East Pittsburgh, subsequently affiliating himself with the Erie Railroad in its electrification survey. At the present time Mr. Kennedy is connected with the Otter Tail Power Company at Fergus Falls, Minn., in the capacity of vice-president and general manager. During his managership he has built up the property from a system serving forty-five towns in Minnesota and North and South Dakota to the present system serving 130 towns.

W. C. L. Eglin, vice-president in charge of the engineering department of the Philadelphia Electric Company, sailed for Europe July 25 aboard the White Star liner *Cedric.*

Charles N. Ring, until recently works manager of the Allied Steel Castings Company, Harvey, Ill., has been appointed assistant director of the Electric Steel Founders' Research Group, succeeding W. J. Corbett, who recently resigned to become secretary-manager of the Steel Founders' Society of America. Mr. Ring has had more than fifteen years' experience in steel-casting manufacture, following his education at Washington University and the University of Missouri.

W. L. Rush has rejoined the Ohio Public Service Company at Lorain in the capacity of distribution engineer, which position was made vacant by the transfer of J. R. Henderson to New York. Mr. Rush was formerly connected with the Public Service Company, but resigned several months ago to affiliate himself with the Mississippi Power & Light Company.

H. Lariviere, chief engineer of the Public Service Commission of Quebec, has been appointed a member of the Canadian National Committee of the International Electro-Technical Commission, with headquarters at Ottawa, Ont. Mr. Lariviere will represent the Engineering Institute of Canada on the commission. The latter body is subsidized by the federal government to inquire into all questions relating to electricity.

Clyde Chamblin, president of the California Electrical Construction Company, San Francisco, has been elected to the executive committee of the National Electric Light Association as a member at large to represent the electragists. Mr. Chamblin is well qualified to act in that capacity because of his long experience and active participation in electrical affairs. For the past three years he has been a member of the executive committee of the Association of Electragists International and a director of the Society for Electrical Development, Inc., for the same length of time. He is a member of the advisory committee of the California Electrical Bureau and a member of the executive committee of the San Francisco Association of Electrical Contractors and Dealers, of which he is a past-president. He is also a past-president of the California State Association of Electrical Contractors and Dealers and of the San Francisco Electrical Development League and a member of the executive committee of the Pacific Coast Electrical Association.

Obituary

Nelson S. Hopkins, director of purchases of the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., died July 4. Mr. Hopkins was also a member of the board of directors.

John S. Speer, president and general manager of the Speer Carbon Company, St. Marys, Pa., died suddenly July 17 as the result of an acute heart attack. Born at Harmarville, Pa., January 4, 1859, Mr. Speer became a prominent figure in the carbon industry. His preliminary training in this field was obtained while he was associated with the Partridge Carbon Company of Sandusky, Ohio. Going to St. Marys in 1898, he interested local capitalists in the carbon industry and at that time organized the company which still bears his name. Immediately upon the formation of the company Mr. Speer was elected president and general manager, and both of these titles he carried up to the time of his death. He also established the first electric light company in St. Marys. The vacancy caused by Mr. Speer's death will probably not be filled by the board for the present.

Recent Court Decisions

Condemnation for Transmission Line Right-of-Way Not Taking Property for Private Use.—In Blair vs. Milwaukee Electric Railway & Light Company the Supreme Court of Wisconsin held that condemnation proceedings by the company to obtain a right-of-way for a transmission line were in the interest of the public and not for the private use of the power company. The court further held that a law in Wisconsin limiting to 32 ft. the land an electric railway was allowed to condemn as right-of-way for its power lines did not apply to a power company building a large steel-tower line, and that the power company was justified in cutting down trees and clearing land to make operation of the transmission line safe. (203 N. W. 912.)*

Customer Whose Service Is Cut Off Cannot Complain if He Has Not Tried to Adjust Differences.—The Supreme Court of Alabama, in Nelson vs. Mobile Electric Company, held that if a customer had been given sufficient time to adjust with the company any disagreement as to the size of the bill and had not taken advantage of this opportunity he could not complain if service was cut off for non-payment of the bill. The period over which the bill in question ran was three months and service was not cut off for another month. The court held, however, that a corrected bill could not be submitted on one day and service cut off the same day for non-payment. (104 So. 407.)

State Commission Has No Control of Interstate Commerce in Electricity.—In a recent decision the Supreme Court of Rhode Island held that the sale and transportation of electricity generated in one state and conveyed directly to a purchaser in another state is interstate commerce. It therefore followed, in the opinion of the court, that it is immaterial that place of delivery or where the title passes is at the state line. Therefore the court held the act of the Public Utilities Commission of Rhode Island in establishing a new electric rate for energy furnished the Attleboro Steam & Electric Company by the Narragansett Lighting Company placed a direct burden on interstate commerce and rendered the action invalid. In making the decision the court quoted the Missouri vs. Kansas Gas case of the United States Supreme Court, the Minnesota rate case of the United States Supreme Court and several similar cases. The court stated: "The case at bar is like the Kansas Gas case. Applying the principles confirmed therein, we think the action of the state commission imposes a direct burden on interstate commerce and consequently is invalid. The interstate and intrastate business of the Narragansett company can be segregated. This separation has actually been made by that company and the commission in establishing a basis for the proposed new rate for the Attleboro company. The effect of the action of the commission was direct on interstate commerce and incidentally on local and state commerce. Such being the case, there is no difference in principle because of the amount of interstate commerce involved, whether it is much or little, at wholesale or retail. The purpose of the state action is immaterial, if the result is to impose a direct burden on interstate commerce." (129 At. 495.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

More Dangerous Method of Doing Work Not Necessarily Negligent.—In Salt River Users' Assocation vs. Wheeler the Supreme Court of Arizona held that trimming trees to prepare for construction of a transmission line was work connected with the construction, and that if there were two or more ways of doing a piece of work and the workman voluntarily chose the less safe method, such action did not of itself constitute negligence, and decision as to the negligence involved was for the jury to determine. The lineman was injured while trimming a tree to make a clear right-of-way for a transmission line which was to be built. He might have used lines and a safe method of clearing a limb which was jammed in the treetop. He used a quicker method, however, and was injured when the limb was freed and fell on him. (236 P. 1108.)

Power Company Held Not Responsible for Injuries Received from Transformer Controlled by Customer.—The Special Court of Appeals of Virginia held, in Haywood vs. South Hill Manufacturing Company, et al., that the Virginia Railway & Power Company, which supplied energy to the manufacturing company at a meter on one of its poles, could not be held liable for an accident to a child which took place at a transformer on the ground 75 ft. from the meter when the transformer and wires leading from the meter to the transformer were owned and controlled by the manufacturing company. The court further held that it was the duty of the owner to place warning signs and take all other precautions possible when high-voltage electrical equipment was placed near a thoroughfare where pedestrians, particularly children, were constantly passing by. (128 S.E. 362.)

Counts Based on Negligent Absence of Defendant's Agent Held Demurrable.—The Supreme Court of Alabama, in Alabama Power Company vs. Conine, held that in an action for death from a charged wire hanging close to the ground counts based on the negligence of the company's agent in being absent from the scene of the accident and in failing to protect against danger were demurrable, since it did not appear that the agent's duties required his presence or that, if on the scene, he would have had any reason to apprehend or anticipate the occurrence causing the injury. One of the company's employees, while handling a charged wire broken down by a storm, was electrocuted, and in attempting to release him the man for whom the suit was brought was killed. The agent referred to was not present since he had a large territory to oversee and one of the company's men was working with the wire. The court further held that the man attempting the rescue was guilty of contributory negligence if the peril of the person whom he was attempting to rescue was produced by his negligence and if the company was not guilty of negligence toward him. (104 So. 535.)

Commission Rulings

Comparison of Rates Possible Only When Services Are Similar in Load Characteristics and Diversity Factor.—The Alabama Public Service Commission recently approved the extension of a cooking rate which the Alabama Power Company had used for domestic customers to cover commercial installations. This extension was made over the protest of two gas companies which maintained that the rates were unfair, unreasonable, unjustly discriminatory, unfairly competitive and unduly preferential in that by encouraging large consumption they offer much lower rates than for lighting or retail power. The commission said: "We do not find that the proposed rate is unfairly competitive for commercial consumers who are presumably large users when compared with gas rates quoted by the Tri-City Gas Company and the Huntsville Gas Company. In this connection it must also be taken into consideration that the petitioner serves directly 53 cities and towns with electricity, of which only eight have gas service, and that in six of these eight towns the petitioner also operates the gas utilities. We are therefore of the opinion that the prospective commercial consumers in the cities and towns of Alabama who do not now have available gas for heating and cooking are entitled to electric service at fair and reasonable rates. The interveners attempt to prove that the proposed rate is unjustly discriminatory and unduly preferential in so far as it affects or relates to the other rates of petitioner by comparing the proposed rate with the present lighting and retail power rates. In the first place, a comparison between different rate schedules is only possible when the load characteristics, the diversity factor, etc., are alike, which is not the case in the rates compared. In the second place, the Alabama Power Company now has effective, with the approval of the commission, over fourteen different rate classifications, no two being alike. Is it, therefore, to be assumed that all but one of the present rate schedules are unjustly discriminatory and unduly preferential? Obviously the fact that rates for service of different character are not alike does not establish unjust discrimination. Experience has taught that there are certain relationships in rates which bring the required income necessary to pay operating expenses, depreciation and a fair return on the reasonable value of the property without overburdening any class of users."

Manufacturing and Markets

Europe More Active in Power Field

Market Good for Electrical and Power Equipment—All Countries Interested in Reducing Power Cost

"EUROPE in general has awakened to world market requirements and is ready to meet modern industrial conditions," in the opinion of George E. Learnard, president of the International Combustion Engineering Corporation, who has just returned from a study of the European situation. "Economic pressure has forced European countries to revolutionize their industrial thinking and practice," he said, "and a widespread movement is under way to increase the economic production and use of power in industry. Electrical markets and those for power equipment have been very active and promise even larger possibilities in the future. In some countries, of course, some industries are very inactive, but everywhere there is a widespread development in power and electricity, as these are fundamental to industrial rehabilitation.

"In Great Britain there is a general stock taking going on," said Mr. Learnard. "Many industries are very quiet, the labor situation is very acute and foreign competition, especially from Germany, has greatly affected foreign trade. The small industry and electrical utility is now recognized as inadequate and plans are under way to consolidate power and industrial enterprises, cheapen production and reorganize industrial and marketing methods. The opinion is held that legislation will permit the consolidation of utilities and industries in the near future. Leaders of industry have agreed that industrial salvation lies in co-operative efforts on their part rather than through government subventions. Labor will necessarily be compelled to modify its demands if the possibilities are realized. Great attention is being given to reducing cost of electric power production."

Mr. Learnard stated that a four-boiler pulverized fuel installation had just been put into operation in Birmingham and a duplicate order has been given. Also plans are under way to install two low-temperature distillation plants at the mines. The coal will be pulverized and distilled and the coke and gases produced will be used in furnaces and boilers of power plants and steel mills. Motor spirits and other by-products will be marketed. In the opinion of Mr. Learnard these installations will prove that low temperature distillation plants have a large economic field of application in England.

In Germany much thought is also being given to the more economical use of fuel and to the development of greater electric power facilities. Several new stations are under way and pulverized fuel, low temperature distillation, high-pressure steam plants and other means to secure economy are very active in development.

Mr. Learnard discovered that in Italy it has been found necessary to supplement hydro-electric power with steam plants and a series of plants have been sold to an important utility in Italy. These plants will use pulverized fuel and new-type steel-walled furnaces. In southern Spain also a new power plant of the same type has been sold by the International Combustion Engineering Corporation. This company will build and operate the station, and the power has already been contracted for by a group of industries.

Mr. Learnard stated that the plants of the company in England, Germany and France all report splendid business, and prospects are good for future increases. The foreign business of the company has doubled during the past year. American power plant practice is ahead of European, in the opinion of Mr. Learnard, and many American developments are now being used there to meet the needs for power. A great expansion of power and electrical facilities is a necessity to European nations to meet the world situation and Mr. Learnard thinks this program will go forward apace in all countries.

Can the Jobber Serve the Syndicate?

Consolidations of Power Companies Create a Real Problem for the Jobber—Large Buying Power of Utility May Be Offset by Stores and Distribution Expense

BY A MIDDLE-WESTERN JOBBER

THE big construction programs of utility syndicates during the past five years have called for large purchases of bulk shipments of construction materials, often in carload lots. The generally favorable prices available in making these large purchases have induced many syndicates to buy practically all of their construction and maintenance materials direct from the manufacturer. The growth of such direct purchases has made necessary the expansion of the purchasing and stores departments until we hear of some utilities building one-hundred-thousand-dollar warehouses and installing elaborate storeroom-handling and record-keeping equipment. The explanation given for this great expansion of direct purchasing and centralized storekeeping has centered around two objects—greater economy in purchasing, and better service from a centralized-stores department. There has always been in the minds of some utility as well as jobber executives a question as to the real economy of this practice, and now that the construction programs of many utilities have settled down to a more even pace, it may be well to consider the value of continuing this practice.

THE PROBLEM FOR THE JOBBER

Before the recent tremendous expansion of generating plant and transmission line facilities, the electrical jobber occupied an important place in the distribution of supplies to central-station companies. Today, in relation to many utility syndicates, the jobber has all but passed out of the picture. Questions that naturally arise are: Will the jobber be able to return? Can the central-station company afford to keep him out? Can the syndicate afford to assume the functions of the jobber, for instance, centralized purchasing, efficient warehousing, sales stimulation?

It may be granted that because of centralized purchasing the syndicate may reduce the f.o.b. factory cost of his goods. It may be granted that in the case of much standardized material the syndicate may equal or better the jobber's price for goods laid down at the point of consumption. But it is open to question whether small shipments can always be laid down at the point of consumption at a lower cost for the syndicate purchase than for the purchase made through a jobber. In the case of rush and special shipments it is questionable whether anything is saved by syndicate purchases.

CHIEF FUNCTION OF THE JOBBER

Efficient warehousing, the chief function of the jobber, requires among other things adequate working capital, adequate warehousing facilities, proper control of stock, adequate personnel, and equipment for prompt service. Each of these items calls for an outlay of capital and a considerable expense for operation. It is difficult to believe that the average utility is able to carry on these functions at a lower cost than the average large jobber. The greater diversity of the jobber's business should reduce his unit overhead cost, the greater volume of business should reduce the unit direct expense, and the wider territory covered by the jobber should reduce the amount of dead stock. As a warehousing agent, the average large jobber should be able to function efficiently and at less cost than the syndicate. For the same capital investment the cost of warehousing and servicing should be in favor of the jobber. If the capital required by the utility is greater than for the jobber there is the carrying charge of this added capital to be paid for by the utility. In the matter of prompt service, the wide-awake jobber should not fear the competition of the centralized

stores department, for not infrequently the jobber's warehouse is more centrally located than that of the utility company.

Some syndicates are willing to use any help the jobber can give in sales promotion work, but feel under little obligation in turn to support the jobber to any appreciable extent. The amount of sales promotion work the jobber can afford to do increases rapidly with the volume of business tendered him. With small amounts of steady patronage from the central-station company the jobber can afford to give only limited sales aid. With a considerable volume of steady business from such sources in his territory the jobber can and will take an active and important place in the development of business.

From the standpoint of healthy development of the entire electrical trade field, the jobber can be of great help as a flywheel to take up the slack in business and to act as a builder of better merchants among the contractor-dealers of the community. A stronger union between the central-station company and the jobber would do much to steady the retail appliance business and could do much to steady the entire machinery of distribution for construction, maintenance and utilization materials. Before embarking on expensive undertakings in centralized warehousing, central-station companies should count all the costs, including capital charges, and should consider the value to the industry as well as to themselves of a strong local jobber organization.

Value and Simplification of Specialties

Specifications Unsuited to Standard Practice Expensive for Purchaser —Simplification by Use of Standard Parts a Way to Lower Cost and Better Service

By G. P. Edmonds
General Manager G. & W. Electric Specialty Company, Chicago, Ill.

USERS of electric specialties may not consider the problem of simplification as being of great importance in the manufacture and application of specialties, consequently, there is a tendency among some purchasers and designing engineers to draw their specifications for specialties in such a fine detail and to such a rigid plan and arrangement as to make the manufacture of the specialty unsuited to the standard practice of the maker. Manufacturers of specialties are generally prepared to produce the article desired in accordance with the specification submitted. It is at the same time of value to the purchaser to know that, in a great many cases, consultation with the manufacturer before drawing the specification would permit the utilization of standard elements making up the finished product and standard arrangement of the various elements in the final job.

It is not to be expected that the purchaser or consulting engineer specifying specialties shall be familiar with the complete line of products manufactured by the producer to whom the specifications are submitted. It is not surprising then to find that frequently specifications and orders for specialties carry with them such minute details as to arrangement, and call for such peculiar conditions affecting the shape and arrangement of the items included, as to make it impossible for the manufacturer to utilize any standard parts or even patterns in the production of the finished article. It is fortunately generally possible to demonstrate to such purchasers the desirability of modifying the specifications so as to permit the use of standard parts, patterns or methods of manufacture to a large enough degree to effect material reduction in the cost of the finished article.

A specific example of the economy that may be effected where the specifications permit the use of standard parts or arrangements is found in the case of an order specifying a special box for underground cable in which the dimensions of the box, together with the particular location of the openings, were such as to make the cost of a box $500. The manufacturer was permitted to suggest the use of potheads made up of standard parts and costing $150. The final arrangement of the cables using the potheads not only effected a saving of 70 per cent in the cost but resulted in a more satisfactory installation than the original special design.

The purchasers of electric specialties should be encouraged to utilize the engineering talent of manufacturers, even when specifications are drawn by the purchaser's consulting engineer. One important advantage of this policy, aside from the almost certain reduction in cost, is the ability to utilize standard assembly from which the "bugs" have been worked out by the manufacturer. Because of the wider and more diverse experience of the manufacturer in the application of this specialty, he should in many cases be able to suggest to the purchaser designs and arrangements that would not only be cheaper in cost but more reliable and economical in operation.

A Benefit to the Industry

In addition to the economy directly resulting from utilization of simplified or standard assemblies of specialties, the manufacturer benefits from orders in which these standard parts or assemblies may be utilized because he is then in a position to place larger orders for production from a given set of patterns and larger orders for raw material of the same specification, resulting in better prices for material and better delivery.

From the preceding example and discussion there may be gained an idea of the opportunity for simplification in the application of electric specialties. These opportunities become of real benefit when the manufacturer is consulted before the specifications are drawn into much detail and when he is permitted to suggest modifications utilizing standard material, patterns, or assemblies to the end that the installation costs less to buy and is more satisfactory and economical throughout its life.

Metals Consumption

Non-Ferrous Requirements Increase— Proportion Consumed in United States Grows Larger

CONSUMPTION of non-ferrous metals in this country continues to increase. The margin between the proportion consumed in this country and that of consumption in other countries also grows broader. The expansion of machinery manufacture in this country is thought to play a large part in the increased demand. Taking the pre-war figures, that is to say the annual average 1911-1913 as a basis, the United States consumed during 1924 116 per cent more copper, 42 per cent more lead, 34 per cent more tin and 49 per cent more spelter. During the same period all other countries combined consumed 10 per cent less copper, 12 per cent less lead, 2 per cent less tin and 15 per cent less spelter.

An equally striking contrast appears in a recent statement by an American authority of the per capita consumption of copper in pre-war years and in 1923:

	Average 1912-1914 Pounds	1923 Pounds
Great Britain	7.25	4.35
Germany	7.03	3.47
France	5.34	6.61
United States	5.49	12.69

This is causing no little apprehension in England and Germany, according to reports. Just after the war machinery manufacturers in those countries expected to be able to drive American machinery out of the world markets. They had the advantage of much lower costs of production and had had more experience in foreign trade. Instead of pre-empting the business as they expected, the proportion of American machinery sold in world markets has increased at a steadily accelerated rate. Instead of reducing the pre-war machinery sold abroad the foreign manufacturers now are wondering what proportion of their pre-war volume of business they will be able to save. A striking fact in connection with the increasing demand for American machinery is the fact that it depends on the excellence of the product for its popularity. The machinery with which it competes sells at lower prices.

Stocks of refined copper in North and South America on January 1, 1925, show a decrease as compared to a year ago. A record of stocks follows:

	Tons
January 1, 1924	155,885
April 1, 1924	119,462
July 1, 1924	112,195
October, 1, 1924	136,756
January 1, 1925	136,454

These stocks are about equal to two months United States consumption, and most of it is sold for forward delivery. While copper producers are not as prosperous as other lines of industry, the copper industry is decidedly active, and is making new records in large size and low cost of production.

Business Conditions

THE electrical industry at large is fully in tune this week with the general optimism of the business world. The seasonal lull in inquiries and sales throughout the industry is far less than had been naturally anticipated. For the first time this year the railroads have loaded a million cars with revenue freight in one week, with no car shortage reported. Bond clearings are very large and production is at a high level, while wholesale trade and wholesale prices are strong and the general business trend is still upward. Particularly good reports on the volume and activity of electrical sales come from New England and the Southeastern states and in California demand appears unusually strong for midsummer. In the two great centers of population, although jobbers are experiencing a seasonal lull, manufacturers' sales continue active and confidence is strong both in New York and Chicago, with full expectations of increased business in September. The utility construction programs go forward and are providing active market, while general building continues strong, particularly in New England. Heating appliance campaigns are quite general and considerable stock is moving. Motor sales, particularly to the steel and automobile industries, have been good. Radio has begun to stir in advance of the autumn movement.

Lighting fixtures have been active in the New England territory, also wiring devices and lighting equipment, in response to very heavy building contracts. Heating appliances are quiet, save in cities where special campaigns are on. In the New York territory jobbers are in a summer lull, but motor manufacturers report good demand for medium and large machines and control equipment is selling stronger, also plug fuses and fuse wire, and industrial lighting shows keener interest. Large orders were placed by utilities in Florida and Alabama for meters, distribution transformers, pole line hardware and for telephone equipment, and conditions in the Southeast are very promising. The volume of sales is slightly off in the Middle West, with jobbers' sales irregular. Fractional horsepower motors were in demand. Cotton lamp cord advanced 5 per cent. On the Pacific Coast large power business is on the move and some railroad buying was reported. Campaign plans have stimulated appliance sales and radio is unusually active.

Demand for Transmission Towers Spasmodic but Averages Good

THE demand for steel transmission towers since the latter part of last year has been rather spasmodic but on the average has been good. One manufacturer reports that he has booked some very good orders and others are in prospect, and he expects to be reasonably busy throughout the year. The demand on the Pacific Coast has been very quiet and practically no large or medium-sized orders have been placed. Several interesting propositions are contemplated, however, and should materialize shortly. Competition is exceedingly keen in that section as elsewhere, and Eastern manufacturers have sent special representatives to the coast to take care of their interests. Early in the year a number of requests were received for quotations for estimating purposes. Some of these have materialized and have helped in creating a slight improvement. One manufacturer reports that he is enjoying a very good export business, which has been of material benefit in increasing the company's output.

Prompt delivery of raw material from the rolling mills enables manufacturers to make quick shipments. These begin in from eight weeks to ten weeks after closing up the contract. Prices are being quoted on an extremely close margin and outside of any possible change created by a decrease in the price of steel, manufacturers state that they do not see how it is possible for prices to be any lower. It is the opinion that prices will remain fairly stationary for the rest of the year.

Sales of Electric Ranges Showing Greatest Steady Increase

SALES of electric ranges are showing the greatest steady increase ever recorded. The demand is fairly well diversified. The best territory at present is the Pacific Coast, the middle North West, New York state and Florida, with some gains also in Pennsylvania and Virginia. Manufacturers believe that the increasing interest in the electric range has been owing principally to the awakening of the public to the use of electricity as a practical cooking fuel, and also to the fact that central-station companies are beginning to realize that the electric cooking load is profitable and that the equipment to be prepared to serve the electric cooking load is not as considerable as once thought. One company feels that at present the manufacturer is expected to carry too much load in the way of advertising and demonstrations. Hotel range sales are running well above last year's figures—the increase is estimated at above 50 per cent. In New England successful electric range service at a Portland (Me.) hotel has led its owners to place a repeat order for equipment for a new hotel built at Manchester, N. H. Many new propositions are also reported as being under way in various sections of the country, and interest is increasing. Foreign business is reported to be increasing rapidly.

Several new models have been placed on the market this year and at least two manufacturers have added electric ranges to their line. One manufacturer states that there is an increasing demand for combination coal-electric ranges. All manufacturers report being able to make prompt deliveries. There have been no radical price changes except in cases where the construction has been changed or considerable improvements made. Prices are firm and labor and material costs are said not to warrant reductions until the industry can get on a mass production basis.

Outlook for Business Better than Earlier in the Year

CONTINUOUS improvement in business should be the order, is the opinion expressed by Horace S. Meese, general sales manager Commercial Truck Company, Philadelphia. "There is no ground for pessimism," says Mr. Meese, "and business conditions throughout the country are fundamentally sound." Mr. Meese has been able to throw considerable light on the business outlook because of extensive traveling and many interviews during the past few weeks.

"The general tendency at present is toward stabilization," said Mr. Reese. "The high-water mark of production and business activity reached the early part of this year compares very favorably with that of the first part of 1924. There have been no sharp declines, as there were a year ago at this time, when the lowest levels were reached since the spring of 1922. This is very satisfying, and while it does not indicate a large sales prosperity it points the way to a continued healthy business. Other favorable signs are: Inventories are in most cases conservative, involuntary unemployment is low, retail trade is holding its own, farmers are receiving more by 30 or 40 cents per bushel for their winter wheat than they did last year. Altogether, the business outlook for the industry for the last six months of this year is more definitely encouraging than it was in the spring months."

Non-Ferrous Metals Prices Remain About the Same

COPPER prices have remained steady this week but the tonnage sold has been the smallest in months. The entire non-ferrous metal market has been exceedingly quiet, the demand for tin being about the only sign of activity. The threat of a coal strike in England has been in part responsible, although it was natural to expect a period of mid-summer stagnation after the recent heavy volume of sales. Producers are all sold up and in no need to make sacrifice prices. Considerable business was done in copper on Thursday and Friday of last week at 14⅝ cents, but on Saturday and Monday resale lots appeared and were taken up at 14¼ cents. A decline in London on Monday increased the cheap offerings by dealers. Export demand has been light, with American agencies continuing to hold their prices at 14.60 cents c.i.f. A small amount has been sold at that price on the Continent.

The contract price for New York lead, set by the American Smelting and Refining Company, continues at 8.20. The so-called outside market is somewhat above this level, however, and spot lead has been offered as high as

NEW YORK METAL MARKET PRICES

	July 22, 1925 Cents per Pound	July 29, 1925 Cents per Pound
Copper, electrolytic	14⅛	14⅛
Lead, Am. S. & R. price	8.20	8.20
Antimony	16½	17½
Nickel, ingot	34	34
Zinc, spot	7.70	7.67½
Tin, Straits	58⅛	58½
Aluminum, 99 per cent	28	27

Base copper price July 29, 1925, 16½ cents.

8⅛ cents New York, with some small sales below this figure. Practically the same condition obtains in the West. Monday was active, but during most of the week inquiries have not been large.

Better Business in Southeast—Utilities the Best Buyers

REPORTS from electrical jobbers generally indicate improvement throughout the Southeastern section in the past few weeks, though spotty conditions are still the rule. The bulk of orders received of late have been from central stations. Florida and Alabama continue in the limelight as regards business done and orders from these sections are excellent. One jobber reports that during the past week he received one order from Florida for $20,000 worth of meters and distribution transformers and another order for creosoted poles amounting to $15,000. Pole-line hardware is also moving very satisfactorily, an Atlanta jobber having received one order this week from Alabama for $15,000 worth of this material. Telephone extension activities are satisfactory, particularly in Florida. An order was received this week from a residential subdivision concern in that state for $30,000 worth of telephone equipment.

Improvement in demand for wiring materials from contractors is to be noted, though small contractors and dealers are placing their orders on a cautious basis. There is report of a pick-up in the movement of residential lighting fixtures, with the demand reasonably satisfactory. Flatirons are selling well, though dealers say that socket appliances generally are slow.

While the long drought continues, intermittent thunder showers have served to prevent serious damage to crops, which at present have a brighter outlook than for several years past, but rains to date have been of little or no value in solving the water shortage problem that is being experienced by all hydro-electric power companies in this section of the country.

Market Steady in New York, Though Jobbers Are Quiet

THE general tone of the electrical market in the New York district this week is steady, with business in most lines stronger than it was this time last year. The jobbing houses are experiencing a summer lull and report little buying at the moment except for an induced demand for flatirons, toasters and percolators due to local sales campaigns supported by advertising by manufacturers. Also, a fair amount of line construction continues, although building programs are nearing completion. There is some movement in conduit and outlet boxes. There is general agreement, however, that there is fine promise of good business in September and an excellent outlook for the fall season. At present jobbers' stocks are very low.

The manufacturers as a class are optimistic. The market for motors this summer has been better than for two years and continues strong, the present demand being better for medium and larger machines than for small sizes, the reason being probably that jobbers are inactive, whereas manufacturers who buy direct are going ahead. The steel and automobile industries seem to be providing the best orders and inquiries. The general improvement shown in the field of control apparatus in June has carried along well, although the business consists mainly of small orders.

Sales of wiring devices are rather slow, but prospects are good. Plug fuses and fuse wire business has increased in the past three weeks, though improvement was not expected until fall. Renewable fuses are reported steady and non-renewable fuses weak. Radio material is beginning to stir in anticipation of seasonal demand. A large order for reflectors was received this week from Philadelphia. Wire holds its position, but with very little movement.

Middle West Holds Stable—Electrical Trade Optimistic

INDICATIONS are that the period of stabilization entered into about in May is continuing in the Middle West. While the volume of business has fallen off somewhat, reports from basic industries are cheerful and optimism is prevalent. Favorable reports are being received from the agricultural districts and building is generally active. The various utility companies are carrying on with their construction programs and some apparatus is being bought. Among the interesting orders placed this week was one for 126,000 lb. of Muntz metal condenser tubes and a quantity of 2,400-amp., 720-kva. current-limiting reactors.

Jobbers' sales have been somewhat irregular in response to the natural influence of the summer season. Sales of irons and fans have gone remarkably well, supported both by the hot weather and manufacturers' activity, with a rather good demand for motors, particularly fractional horsepower. Considerable quantities of Christmas tree outfits and lamps were purchased this week in Chicago.

Prices remain firm. Cotton covered lamp cord prices advanced approximately 5 per cent this week and manufacturers in this territory look for further advances.

Electric Lighting Fixtures Active in New England

LIGHTING fixtures are in active demand throughout New England due to the continuance of an unparalleled seasonal boom in building. Therefore, wire, switches, sockets, and miscellaneous devices for residential lighting are moving in good volume. Industrial electric lighting also is progressing and much interest is manifested in reflectors, store units and display illumination.

An upward trend in sales of small motors appears to be maintained throughout this district. One manufacturer reports, that at the present pace, the late spring slump in sales will soon be overcome; another records sales to date to exceed in volume by about 14 per cent the total for a corresponding period in 1924. Single orders in small motors govern as a rule, with the demand strong for small horsepower capacities.

Transmission line supplies are moving favorably and power units are attracting considerable interest. Electric heating is reported brisk among tool-makers but somewhat lagging in other lines throughout this territory. The outlook for fall business in this line is reported to be very promising on the basis of many inquiries and demands for quotations. Household appliance sales are spotty.

While many jobbers profess to see a summer slump in sales, business on the whole is far from discouraging. One group consisting of fourteen stations reports sales of household electrical appliances to date amounting to $416,616 as compared with a total of $287,644 for a corresponding period of last year.

Pacific Coast Business Good—Line Material and Radio Strong

THE crop outlook and general business conditions this week on the Pacific Coast are excellent and the prospects of some very large purchasing by power companies promise record-breaking sales totals for the electrical industry for the balance of the year. The $8,500,000 Bald Rock Canyon project of the Great Western Power Company is now very much in the picture.

The new power already available in California has necessitated vigorous campaigns for new loads. A reaction that was somewhat unexpected so early has been inquiries from banks and factories covering electric cooking equipment for employees' cafeterias. Other power company purchasing has included 30-ft. and 40-ft. poles, guy clamps and hooks, 7,500-volt insulators in 100 and 200 lots and a carload of 7,500-volt line switches from southern California. Railroad purchasing has included supplementary despatching equipment for the Sacramento district of the Southern Pacific and flashlight renewals for the Santa Fé yards and shops. Contractors' business is steady and good. Among the week's unusual orders were 1,700 conduit couplings for Mexican export, 1,000 lb. of resin core solder, 500 cast brass outlet boxes and 200 resistance lamps, 660 ohms.

Radio business has apparently been helped rather than hindered by the vacation period. Campers' sets, loud speakers and amplifiers have been the features, stocks of the last two items being practically exhausted. The sale of a broadcasting equipment to a San Francisco tabernacle was reported during the week. Dealers' business is proportionately better in the interior than along the coast and among the specialties waffle irons, percolator sets and flashlights are selling particularly well.

In the Northwest interest is keen in the impending award by the Seattle Board of Public Works of a contract for 180,000 lb. of copper wire, the low bid received totaling $31,423.

Activities of the Trade

Westinghouse Appoints Street Lighting Engineers

The appointment of the following four new street lighting engineers, effective immediately, has been announced through the supply department of the Westinghouse Electric & Manufacturing Company; C. F. Pearson at Jacksonville, Fla.; I. B. Boyer at Dallas, Tex.; L. F. Watson at Los Angeles, Cal.; H. W. Lingenfelter at Chicago Ill.

Announcement is also made that William A. Rossel has been appointed manager of the central-station division of the New York office, and that C. M. Kirkpatrick, in addition to his present duties as syndicate representative of the New York office, has been appointed assistant manager of the central-station division and will be responsible for the sale of all supply apparatus throughout the district.

Allis-Chalmers Gets 50,000-Kw. Turbine Order for Waukegan

The Allis-Chalmers Manufacturing Company, Milwaukee, has just received an order for a 50,000-kw. steam turbine unit to be installed in the Waukegan station of the Public Service Company of Northern Illinois. This is an Insull property and Sargent & Lundy are the engineers.

This is the third unit provided for this station, the first being a 25,000-kw. Allis-Chalmers unit, which has been in operation for a number of years. The second unit, a 35,000-kw. Allis-Chalmers turbine, was placed in operation last winter. The new unit as well as the two units previously installed operated in connection with Allis-Chalmers condensers.

The contract is in the million-dollar class and it is expected that close on to fifteen months will be required to complete the order.

Radio Corporation Reports Poor Quarter

The Radio Corporation of America in its statement for the second quarter of the year reports a deficit of $391,053, this after charging off depreciation, patent amortization, federal taxes and accrued reserve for year end adjustments. Gross income for the second quarter was but $4,584,465, compared with $15,229,923 for the first quarter. No figures for the second quarter a year ago are available for comparison, but it is understood that the quarter's net approximated 8 per cent of the gross. The net earnings for the first six months of 1925 were $1,537,276, equivalent after preferred dividends to 73 cents a share on the 1,155,400 no par shares compared with about $1,737,276 or 90 cents a share for the first half of 1924.

The Miller Company, Meriden, Conn., has prepared a new "De Luxe Sales Service" book which it plans to mail on August 3 to every lighting company in the United States that merchandises portable lamps. The book contains a number of sales suggestions as well as copies of available literature descriptive of the portable lamps made by the Miller Company.

Curtis Lighting, Inc., 1119 West Jackson Boulevard, Chicago, announces the appointment of three new men to its staff of sales engineers. They are: W. K. Turner, who goes to the Detroit office; J. L. Marsh, who will be associated with the Philadelphia office, and L. B. Pierson, who goes to the Rochester (N. Y.) office.

The Conlon Corporation, Chicago, announces the appointment of H. D. Broughton as sales manager in charge of Conlon trade-marked washing machines, with headquarters at the general offices of the corporation at Fifty-second Avenue and Nineteenth Street.

The General Electric Company, at its Erie, Pa., plant, is rapidly completing work on a large brick and steel warehouse 220 ft. x 440 ft. in size, and expects to have the building in use about October 1.

The Square D Company, Detroit, manufacturer of electrical safety devices, announces the following changes in its personnel: E. W. Chapman, formerly district sales manager in the Detroit district, has been appointed assistant sales manager of the company; J. J. Mitchell, who has been district sales manager in the St. Louis district, has been made district sales manager in the Pittsburgh district; T. R. Gano, former Pittsburgh district sales manager, has been transferred to the Detroit district as sales manager; H. N. Foster has been made St. Louis district sales manager. He formerly represented the company in the Texas territory. Also, Howard D. Fearey has been placed in charge of the Portland (Ore.) territory, succeeding H. R. Drew, who has resigned.

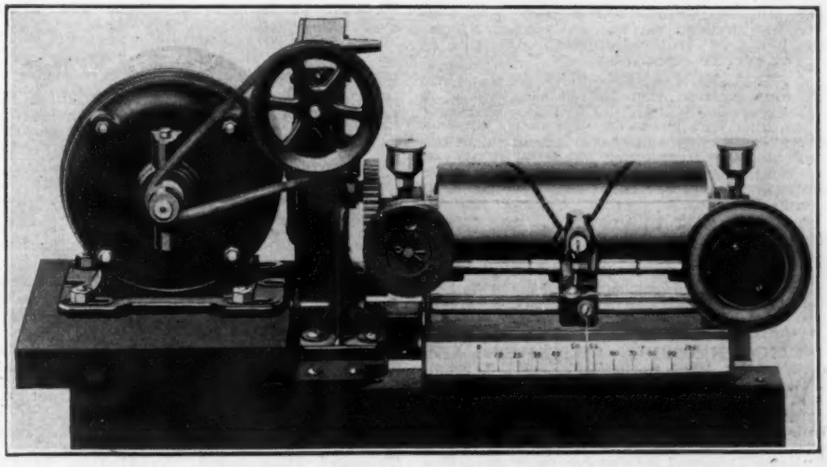
New Equipment Available

Alternating-Current Adjustable-Speed Drive

An alternating-current motor drive giving an infinite number of speeds applicable to constant average speed requirements has been developed by the Louis Allis Company, Milwaukee. This drive, known as the "Allis Adjustable Delivery Motor Drive," makes possible the use of an alternating-current drive for adjustable speed applications of this class. The drive consists of three elements, the L-A multi-speed squirrel-cage alternating-current motor, a revolving drum for establishing the average speed, and contactors for switching the motor.

In the operation of the drive a fractional-horsepower motor is used to revolve the selector switch drum at 1 or 2 r.p.m. By changing the position of a movable brush, a two-speed motor, for instance, can be made to run all the time on the high speed, all the time on the low speed or any desired portion of time on the high and low speeds. By choosing a motor the high speed of which is faster, and the low speed lower, than it is ever desired to run, an infinite number of steps can be obtained. This drive is particularly adapted for use with stokers, conveyors, traveling ovens and equipment where a constant average speed that may be infinitely varied is desired.

Wire Straightening Machine.—A machine for salvaging old wire has been placed on the market by the Kane & Roach Company, Syracuse, N. Y. The machine is simply constructed and it is said that it will salvage 95 per cent of the wire put into it. The machine is so arranged that once it is adjusted it is unnecessary to readjust the rolls for each size of wire other than to raise or lower the last roll to correct the tendency of the wire to go up or down as it is delivered from the machine. It has a capacity of $\frac{1}{16}$-in. to $\frac{3}{8}$-in. wire at from 150 ft. to 200 ft. of wire a minute, and is driven by a Westinghouse 2-hp. motor.



CONTROL DRUM WHICH MAY BE LOCATED AT ANY POINT. THE UNIT IS MOUNTED IN A DUST-PROOF STEEL CABINET

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Purchase and agency is desired in Bucharest, Rumania (No. 15,930), for brushes, motors and generators, electrical toys, wiring and wiring apparatus, fixtures, meters and protective apparatus.

Purchase is desired in Dresden, Germany (No. 15,973), of insulating forms of hard rubber and vulcanized fiber and radio crystals.

An agency is desired in Ghent, Belgium (No. 15,932), for radio parts.

Purchase and agency is desired in Belfast, Ireland (No. 15,931), for radio parts and accessories.

Purchase is desired in Melbourne, Australia (No. 15,977), of telegraph equipment.

An agency is desired in Antwerp, Belgium (No. 15,933), for wireless apparatus and accessories.

Sole agency is desired in Amsterdam, Netherlands (No. 15,962), for wireless sending and receiving apparatus.

ELECTRIC POWER STATION FOR DURBAN, SOUTH AFRICA.—Tenders will be received by the Electricity Supply Commission of Union of South Africa, 82 Marshall Street, Johannesburg, South Africa, until Oct. 13 for electric power station and equipment at Durban. The work will include buildings, overhead electric traveling crane, pulverized fuel equipment, coal and ash-handling plant, two 12,000-kw. turbo-alternators, condensing plant and auxiliaries, transformers, etc. Merz & McLellan, 32 Victoria Street, London, S. W. 1, are consulting engineers. For details see Searchlight Section.

TRANSFORMERS FOR MELBOURNE, AUSTRALIA.—Tenders will be received by the State Electricity Commission of Victoria, Melbourne, Australia, until Sept. 21 for 250-kva., 22,000-volt transformers and spares. Specifications have been issued by the commission and are available at the New York and Chicago district offices of the Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C.

New Trade Literature

LAMPS AND LIGHTING FIXTURES.—The Miller Company, Meriden, Conn., has issued a program of selling helps entitled "A De Luxe Sales Service" for all public-service companies that merchandise lighting equipment. This program has been approved by the seventeen merchandising executives to whom it was presented for comment before production was started. It contains suggestions for magazine and newspaper advertising, copies of bulletins for distribution, different methods for selling lamps and instructions for display of lamps and other Miller products from the point of view of the public-service company. The company is also distributing a booklet containing suggestions for newspaper advertisements of Miller lamps for the use of public service companies.

STEAM TURBINE—"The New Steam Turbine System Bruenn" is the title of a catalog issued by the Erste Bruenner Maschinen-Fabriks-Gesellschaft, Bruenn, Moravia, Czechoslovakia, which describes and illustrates the new Bruenner turbine. It contains engineering information and gives some interesting features of that steam turbine.

LIFT TRUCK PLATFORM.—The Lewis-Shepard Company, Watertown Station, Boston, is distributing a folder in which it announces a new type of lift truck platform and calls attention to six important features of the platform design. It also contains an illustration showing the new plant of the company.

DISCONNECTING SWITCHES AND OUTDOOR BUS SUPPORTS.—The Champion Switch Company, Buffalo, is distributing bulletin C, covering its indoor disconnecting switches, in which it gives details of construction, line drawings showing various mountings and dimension tables. Bulletin D issued by the company describes its outdoor bus supports. Drawings are given showing the interchangeable parts for various mountings. Dimension tables and instructions for stacking are included.

SWITCHBOARD INSTRUCTION BOOK.—The General Electric Company, Schenectady, N. Y., has issued booklet No. 87,000-E, entitled "Switchboards, Installation, Operation and Maintenance," containing instructions for installing and operating switchboards. Illustrations are given showing various types of switchboards, with diagrams, tables, formulas, etc.

HEAVY-DUTY GRINDER.—Bulletin No. 1,306 issued by the Hisey-Wolf Machine Company, Cincinnati, Ohio, describes and illustrates the Hisey 5-hp. production grinder, equipped for 18-in. diameter by 3-in. face grinding wheels.

ELECTRIC CORD AND WIRE STRIPPER.—A circular issued by A. Laubscher, 77 Fort Pleasant Avenue, Springfield, Mass., covers the "Acme" electric cord and wire stripper.

SCREW PUMPS.—William E. Quimby, Inc., 209 Parkhurst Street, Newark, N. J., is distributing a booklet describing the Quimby screw pumps for handling water, oils and semi-liquids, in capacities from 1 to 4,200 gal. per minute. It calls attention to the advantages of these pumps and contains tables showing loss of head in feet due to friction when discharging water in pipes, etc.

INSULATION TAPE.—The Elkhart Rubber Works, Elkhart, Ind., is distributing a leaflet covering its "Hydro-Proof" tape, which is designed for high-voltage insulation and for use in any work where moisture or even constant immersion in water must be endured.

ADJUSTABLE SPEED MOTOR DRIVE.—A bulletin entitled "Allis Adjustable Delivery Motor Drive for Alternating Current" has been issued by the Louis Allis Company, Milwaukee, Wis. The bulletin describes and illustrates the multi-speed alternating-current motor, the control drum and the contactor panels that make up the equipment. The principle of operation of the device is included in the bulletin.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

PORTLAND, ME.—Bids will be received by the Supervising Architect, Treasury Department, Washington, D. C., until August 18, for lighting fixtures, wiring, etc., for the local marine hospital.

SKOWHEGAN, ME.—Plans for the rebuilding of the paper mill of the Savage Paper Company, recently destroyed by fire, causing a loss of about $150,000, include a power house.

MORRISVILLE, VT.—The Board of Water and Light Commissioners plan to install an outdoor step-up transformer station. C. A. Slayton is secretary.

MERIDEN, CONN.—Plans are being considered for the construction of a power house, laundry, bakery and kitchen at the Connecticut School for Boys, for which $120,000 has been appropriated.

Middle Atlantic States

BROOKLYN, N. Y.—The Knox Hat Company, 601 Grand Avenue, is considering building a power plant. Fletcher-Thompson, Inc., 415 Lexington Avenue, New York, is architect and engineer.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until Aug. 4 for furnishing electric heaters, flat irons, percolators and toasters, etc., at the Navy Supply depot, South Brooklyn.

BUFFALO, N. Y.—The Buffalo General Electric Company contemplates removing the overhead lines on Ridge Avenue and placing the wires in conduits.

BUFFALO, N. Y.—The Fairmont Creamery Company of New York contemplates the construction of a power plant in connection with a warehouse at 197 Scott Street, to cost about $250,000.

BUFFALO, N. Y.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Aug. 19 for furnishing and installing one controller, etc., for elevator at the United States Marine Hospital, Buffalo. For details see Searchlight Section.

BUFFALO, N. Y.—The City Council has contracted with the Buffalo General Electric Company for street-lighting service for a period of three years. Extensions and improvements will be made, including larger and improved lighting units.

RAYBROOK, N. Y.—Bids will be received by the Superintendent of Purchase, Capitol, Albany, until Aug. 10 for construction, including heating, sanitary and electric work, of laboratory at the New York State Hospital for Incipient Tuberculosis.

MILLBURN, N. J.—Permission has been granted the Jersey Central Power & Light Company, Morristown, to issue 35,000 shares in capital stock, no par value, to be used to acquire the property of the Millburn Electric Company. Extensions in transmission lines are planned.

MILFORD, N. J.—The New Jersey Power & Light Company, Dover, is negotiating for the purchase of the municipal electric plant. If taken over improvements will be made to the present system.

ORANGE, N. J.—The Orange Merchants Association is negotiating with the City Commission for the installation of improved lighting system on Main Street.

MEDIA, PA.—Plans for rebuilding the local mill of the Sackville Mills, Inc., recently destroyed by fire, with a loss of about $125,000, includes a power plant.

NEW CASTLE, PA.—Plans for the proposed local plant of the Grasselli Powder Company, Guardian Building, Cleveland, Ohio, for the manufacture of electric fuses, etc., include a power house.

PITTSBURGH, PA.—Bids will be received by the board of trustees, Western State Penitentiary, Northside, until August 3, for electric materials for the institution, to be delivered at Rockview, Center County.

SCRANTON, PA.—Plans for the proposed new plant of the Stegmaier Brewing Company include a power house.

WILMINGTON, DEL.—The Wilmington & Philadelphia Traction Company plans to build a substation on West Tenth Street, near Lincoln Street.

CHARLESTON, W. VA.—Plans for the proposed refractory plant to be built in this district by the Elkland Fire Brick Company, Bank of Commerce Building, to cost about $100,000, include a power house.

CUMBERLAND, W. VA.—The Crescent Brick Company plans to build a power house at its proposed vitrified sewer pipe plant in the Yellow Creek section, to cost $250,000.

WASHINGTON, D. C.—Bids will be received by the Purchasing Agent, Post Office Department, Washington, until August 3, for three 5-hp. motors. Also, until August 5, for 100 double pole snap switches, 20 amp.

WASHINGTON, D. C.—Bids will be received at the office of the Purchasing Officer, the Panama Canal, Washington, D. C., until Aug. 10 for motor trucks, electric oven, glass tube fuses, marine boxes and fixtures, voltmeters, transformers as per circular No. 1687.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until August 13, for motors, transformers, electric bells, electric welding outfits, cable, etc. (Panama Circular 1684.)

WASHINGTON, D. C.—Bids will be received by the Quartermaster, Marine Corps, Washington, until August 4, for electrical supplies, including 9,000 ft. copper wire; 250 ft. armored conductor; 10 surface cabinets; 200 fuses, etc. (Schedule 70.)

WASHINGTON, D. C.—Bids will be received by the Chief Signal Officer, United States Army, Washington, until August 6, for telephone supplies, including transmitter buttons, cords, dials, switches, mouthpieces, etc. (Circular C.P. 20991-1). Also, until August 15, for two Wheatstone bridges, three scale and lamp stands, and two resistances (Proposal C.P. 21388-1.)

North Central States

CRYSTAL FALLS, MICH.—The McKinney Steel Company plans to rebuild its local power plant, recently destroyed by fire, with a loss of about $40,000.

DETROIT, MICH.—Electric power equipment will be installed in the proposed addition to the plant of Dodge Brothers, Inc., Joseph Campau Avenue, consisting of a group of eight buildings, to cost about $7,500,000.

DETROIT, MICH.—Plans have been filed by the Public Lighting Commission

for the construction of a substation, on Livernois Avenue, to cost about $150,000.

ELK RAPIDS, MICH.—The property of the Elk Electric Company has been acquired by the Michigan United Light & Power Company, Ludington. Extensions and betterments, to the system and transmission line are contemplated.

CLEVELAND, OHIO—Plans are being considered by the Division of Light and Power for an addition to the municipal electric plant at East Fifty-third Street and the Lake front. A machine shop will also be erected. H. Kregelius, City Hall, is architect.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until Aug. 5 for covering all of the city's requirements of dry batteries for a period of one year. Separate bids will also be received until Aug. 7 for pipe covering and for fiber duct for the Division of Light and Power.

PORTSMOUTH, OHIO.—The installation of an electric traffic control system throughout the business section of the city is under consideraion by the City Council.

TOLEDO, OHIO.—The installation of 118 additional arc lamps on the Summit Street extension has been approved by the City Council.

DANVILLE, KY.—Steps have been taken by the Chamber of Commerce for the installation of an ornamental lighting system in Danville. Electric service is supplied by the Kentucky Utilities Company, Louisville.

BROWNSTOWN, IND.—The Interstate Public Service Company, Indianapolis, which recently acquired property of the Brownstown Water & Light Company and the system of the Jackson County Transmission Company, plans extensions in its transmission lines in this section.

AURORA, ILL.—A contract has been awarded by the Western United Gas & Electric Company to Stone & Webster, Inc., Boston, for the installation of a 20,000-kw. turbo-generator and two additional 1,000-hp. Stirling boilers with chain grate stokers in its local plant. The entire forced draft system will be remodeled and new equipment installed. The boiler room will be remodeled, providing for ash tunnels, a fan room, and a skip hoist for ash handling will be erected; extensions to coal-handling equipment will also be made. In addition a 33,000-volt transmission line will be erected between Elgin and Glen Ellyn, 20 miles long, with a low-tension substation at Glen Ellyn.

CHICAGO, ILL.—A permit has been granted the Commonwealth Edison Company to build a substation at 11632 Front Street, to cost about $75,000.

CHICAGO, ILL.—The H. W. Caldwell & Sons Company, 1700 South Western Avenue, plans to build a power plant at 2430 West Eighteenth Street, to cost about $200,000. Moore & Nealy, 219 East Superior Street, are engineers.

ELGIN, ILL.—The Aurora, Elgin & Fox River Electric Company has awarded a contract to Stone & Webster, Inc., Boston, for an addition to its local 33,000-volt substation.

ELGIN, ILL.—The Western United Gas & Electric Company, Aurora, has petitioned the Commerce Commission for authority to erect a transmission line between Elgin and Glen Ellyn, and to a point between Wheaton and Glen Ellyn, to connect with its existing line on the Naperville-Wheaton Road.

MURPHYSBORO, ILL.—Extensions and improvements are contemplated by the Southern Illinois Gas Company to its local gas, waterworks and electric plants, to cost about $300,000. New equipment, including two 500-hp. boilers and a 450-kw. steam-turbine generating unit will be installed.

QUINCY, ILL.—Plans are under way by the South Side Merchants' Association for the installation of an ornamental lighting system on Eighth Street from Main Street to Ohio Street and on State Street, from Seventh to Ninth Street. It is proposed to use ornamental standards, mounted with a single lamp of 250 cp. The cost is estimated at about $1,000 to the block.

SPRINGFIELD, ILL.—Plans are being prepared for improvements to the municipal electric plant, including the installation of an 8,000 or 10,000-hp. turbo-generator, to cost from $125,000 to $175,000.

BARABOO, Wis.—The construction of a hydro-electric power plant at Honey Creek flats, near Prairie du Sac, is under consideration by the Supervisors of Sank County.

BARRON, WIS.—The City Council has approved an expenditure of $20,000 for the installation of an oil-burning generating unit in the municipal electric plant to supplement the two municipal water plants.

BELOIT, WIS.—Plans are under way by the Northwest Utilities Company, Chicago, which recently acquired the property of the Beloit Water, Gas & Electric Company, to erect transmission lines to connect with the systems of the Wisconsin Power & Light Company and the Southern Wisconsin Electric Company, nearby to the north and the east. Another line from the south will be built to connect with the system of the Illinois Northern Utilities Company.

GREEN BAY, WIS.—The Byllesby Engineering & Management Corporation, Chicago, which recently acquired the properties of the Wisconsin Public Service Corporation, announce that it will carry out the expansion plans in progress by the Wisconsin Corporation, which included the construction of a large steam-driven generating plant and a large central office building in Green Bay. Plans for the proposed power plant have been altered to provide for a much larger plant than originally planned. A survey is to be made with a view of erecting a transmission line across the state connecting with the properties of the Northern States Power Company.

JANESVILLE, WIS.—Plans are under way by the Wisconsin Power & Light Company which will make Janesville a power center for this part of the state. The work will include the installation of a 200-kw. direct connected vertical type, waterwheel-driven generating unit, at its Monterey plant, to cost about $40,000. Later an addition will be added to the power station to house a new generating unit, with provision for a second unit when the demand requires. A 5,000-kw. synchronous condenser will be installed in the Eastern Avenue substation, at a cost of $35,000. A third transmission line is to be erected into the city, connecting with the system of the Beloit (Wis.) Water, Gas & Electric Company. This line will have a capacity of 33,000 volts, but will carry 13,000 volts until a power boost is necessary.

KAUKAUNA, WIS.—The Green Bay & Mississippi Canal Company has applied to the Federal Power Commission for authority to build a hydro-electric plant at Rapid Croche dam, located about 4 miles below Kaukauna on the Fox River. The plans call for a development of 3,800 hp., to cost about $500,000. A transmission line will be erected from the proposed plant connecting it with its plant at Kaukauna. When completed both plants will be leased to the city of Kaukauna.

MENESHA, WIS.—The Railroad Commission has granted the City Council permission to extend the transmission lines of the municipal lighting system to supply electricity to consumers in adjacent rural districts. An additional Diesel engine driven generating unit will be installed to enable the plant to furnish this service.

ROYALTON, WIS.—The village officials have granted the Wisconsin Traction, Light, Heat & Power Company, Appleton, a franchise to furnish electricity here. A high tension transmission line will be erected from New London to Royalton.

WISCONSIN RAPIDS, WIS.—Arrangements have been completed by the Nekoosa-Edwards Paper Company to build a new power plant, equipped with two 1,000-hp. hydro-electric units, with provision for the installation of a third unit when the demands requires. The cost is estimated at about $250,000.

ST. PAUL, MINN.—Plans have been prepared by the Chicago, Milwaukee & St. Paul Railroad Company for the erection of a power plant on Terrace Road, to cost about $35,000.

MALDEN, MO.—The Council is considering calling an election to vote on a proposal to issue $52,000 in bonds for improvements to the municipal electric plant and for waterworks. F. L. Wilcox, Chemical Building, St. Louis, is engineer.

HIGHMORE, S. D.—Plans are being prepared for improvements to the municipal electric plant, including the installation of a 75-hp. generating unit and changing the system from direct to alternating current. Harry Kjelmyr is manager.

MASKELL, NEB.—Bonds have been authorized for the erection of a transmission line to secure electricity for local service.

EMPORIA, KAN.—The Kansas Electric Power Company, Lawrence, which is erecting a 5-mile extension to connect with the line into Cottonwood Falls, plans to build a transmission line from Lebo to Reading to supply electric service there.

TOPEKA, KAN.—Plans are being prepared for the installation of ornamental lamps on East Fifth Street, covering six blocks.

Southern States

ATLANTA, GA.—The construction of an electric power plant and brick manufacturing plant is reported to be under consideration by Luther C. White, superintendent of prisons.

FORT LAUDERDALE, FLA.—The Florida Power & Light Company, Miami Beach, has acquired a site on Cunningham Avenue, on which it will erect a substation.

INVERNESS, FLA.—The City Council is considering the purchase of the local electric plant. If taken over improvements will be made to the system. E. V. Camp and associates, Moreland and DeKalb Avenues, Atlanta, Ga., are engineers.

LAKE CITY, FLA.—Bids will be received by the Construction Division, Veterans' Bureau, Washington, D. C., until August 18, for outside electric service, ground lighting and fire alarm system at Hospital No. 63.

MADISON, FLA.—The municipal electric plant is reported to have been acquired by the Valdosta (Ga.) Lighting Company, which plans to erect a transmission line to Madison, a distance of about 28 miles, to cost about $50,000.

ST. AUGUSTINE, FLA.—Electric power equipment will be installed at the proposed local locomotive and car repair shops of the Florida East Coast Railway Company, to cost about $500,000. Battey & Kipp, 123 West Madison Street, Chicago, are engineers.

ST. PETERSBURG, FLA.—A special election will be held on September 8, to vote on the proposal to issue $235,000 in bonds for extensions to the municipal electric plant, including the installation of two new generating units, etc.

WEST PALM BEACH, FLA.—The City Council plans to install a fire and police alarm system to cost about $50,000. Also, a signal system for municipal service, to cost about $35,000.

CHATTANOOGA, TENN.—The installation of ornamental lamps on Eleventh Avenue has been approved by the City Council.

KNOXVILLE, TENN. — The Knoxville Power & Light Company plans to install an underground conduit system on a number of streets in the business section.

CLANTON, ALA.—A franchise has been granted the Alabama Power Company, Birmingham, to erect a transmission line from its local plant to Thorsby and Jemison.

DUCK HILL, MISS.—The City Council has granted the Mississippi Power & Light Company, Jackson, a twenty-five year franchise to supply electricity here.

GRAVETTE, ARK.—The installation of a 90-hp. gas engine in the municipal electric plant is under consideration.

CROWLEY, LA.—Plans are under way by A. E. Boger, 350 East Fifty-sixth Street, Chicago, to organize a company, to be known as the Central Louisiana Light & Power Company to generate and distribute electricity throughout southern Louisiana. The present plans call for the construction of 60,000-hp. steam-generating plant on the Mermentau River, near Crowley. The cost is estimated at $11,000,000.

DUNCAN, OKLA.—Bonds to the amount og $110,000 have been authorized for improvements to waterworks, including seven deep wells, additional power unit, etc.

OKMULGEE, OKLA. — The Oklahoma Power Company contemplates the erection of a 23,000-volt transmission line from Okemah to Castle and Boley, with distribution system in each town, to cost about $30,000.

EDNA, TEX.—The Edna Electric Light & Ice Company plans to erect a transmission line from El Campo to Edna.

JASPER, TEX.—The East Texas Light & Water Company, recently incorporated, plans to construct and operate an electric plant and waterworks here. M. L. Howard of San Antonio, is interested in the company.

MENARD, TEX.—The West Texas Utilities Company, Ballinger, is planning to extend its transmission system from Ballinger to Menard, via Paint Rock and Eden, where it has acquired the plant of the Menard Light & Power Company. The cost of the line and other improvements is estimated at $150,000.

SAN ANTONIO, TEX.—The Lone Star State Power Company, recently organized, has acquired the electric plants at Floresville, Kyle, Buda, Round Rock, Hutto, Burnet and Bertram.

TAYLOR, TEX.—The Texas Power & Light Company, Dallas, has acquired a site in Taylor, for a proposed substation, to cost about $100,000.

Pacific and Mountain States

SEATTLE, WASH.—The annual report submitted by J. D. Ross, superintendent of lighting, urges the expansion of the Skagit River hydro-electric project, and particularly emphasizes the development of the Ruby Creek unit of the Skagit. The report states that a 200,000-hp. plant could be built for $11,000,000. This amount includes a railway from the present plant to Ruby Creek, at a cost of $1,000,000, and an arch dam to be installed under the supervision of the government at a cost of $2,000,000.

SOUTH TACOMA, WASH.—A committee has been appointed by the Lake Improvement Club to make investigations relative to securing electric light service for the district. C. Tucker is president of the club.

TACOMA, WASH.—The Municipal Light Department is planning to place the electric wires underground in ten blocks in the business district during this year. Llewellyn Evans is general superintendent.

LOS ANGELES, CAL.—Plans have been prepared by the Bureau of Light and Power, for a substation to be erected on Mateo Street, to cost about $125,000.

LOS ANGELES, CAL. — Arrangements are being made by the Bureau of Light and Power, for the construction of two substations, at 11211 Missouri Street, and 856 West Ninety-first Street, respectively, to cost about $50,000.

OAKLAND, CAL.—Bids will be received by the East Bay Municipal Utility District, Ray Building, 1924 Broadway, until Sept. 4 as follows: (1) For construction of dam about 350 ft. high; (2) an aqueduct of tunnels and pipe lines about 90 miles long; (3) a pumping plant and auxiliaries. John H. Kimball is secretary.

SAN FRANCISCO, CAL. — Plans have been prepared by the Pacific Gas & Electric Company for the construction of a boiler building and generator building, at Maryland and Humboldt Streets, to cost $60,000.

SAN FRANCISCO, CAL.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until August 4, for three portable electric drills for the Mare Island navy yard (Schedule 4079.)

SOUTH SAN FRANCISCO, CAL.—The Western Pipe & Steel Company plans to install electric power equipment in its new group of shops, to cost about $900,000.

GEM, IDAHO—The Hecla Mining Company, Wallace, Idaho, plans to install electric power equipment in connection with additions in its local concentrating mill, to cost about $150,000.

SHERIDAN, WYO. — Bids are being asked by the Sheridan County Electric Company, 54 South Main Street, for material for the construction of about 7 miles of 22,000-volt, three-phase transmission line. When completed it will give a double circuit from its power plant at Acme, about 10 miles distant. Thomas Hughes is superintendent.

Canada

COUTTS, ALTA.—Plans for the proposed local oil refinery to be erected by the Arro Refining Company, Lewiston, Mont., to cost about $300,000, include a power plant.

FORT ALEXANDER, MAN.—Plans are under way, it is reported, by the engineers of the Spanish River Pulp & Paper Company, Dayton, Ohio, for the construction of a plant at Fort Alexander for the Manitoba Pulp & Paper Company, Ltd., McArthur Building, Winnipeg. The cost of the plant is estimated at $4,500,000. Bids, it is understood, will be soon asked for. The equipment will include pulp and paper mill machinery, generators, motors, accessories.

REGINA, SASK.—The Municipal Electric Light and Power Department is considering the installation of an additional generating unit in the municipal electric plant.

Miscellaneous

PONCE, P. R.—The Ponce Electric Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, for the installation of an additional 1,500-kw. turbo-generator with barometric condenser and auxiliaries and a 300-hp. boiler with oil burners at its power plant. Extensions will be made to the turbine and boiler rooms, and the spray pond will be enlarged.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 30, 1925)

1,543,729. ELECTROLYTIC CELL; J. Slepian, Wilkinsburg, Pa. App. filed Dec. 22, 1919.

1,543,730. MEASURING SYSTEM; B. H. Smith, Turtle Creek, Pa. App. filed March 8, 1919. For summating the various increments of power supplied to a circuit at a plurality of widely separated points.

1,543,734. TROLLEY CONDUCTOR AND SUSPENSION MEANS THEREFOR; P. G. Swars, Pittsburgh, Pa. App. filed Oct. 27, 1923.

1,543,736. METHOD OF AND MEANS FOR TRANSLATING PRESSURE VARIATIONS; P. Thomas, Edgewood, Pa. App. filed Nov. 14, 1922.

1,543,737. AUTOMATIC ELECTRIC TOASTER; F. Thornton, Jr., Pittsburgh, Pa. App. filed March 13, 1924.

1,543,753. THERMOSTAT SIGN FLASHER; C. G. Dominic, Springfield, Mo. App. filed Aug. 11, 1923.

1,543,772. APPARATUS FOR NEUTRALIZING RADIOINTERFERENCE ON WIRE LINES; R. N. Hunter, Brooklyn, N. Y. App. filed Nov. 20, 1922.

1,543,775. APPARATUS FOR NEUTRALIZING RADIOINTERFERENCE ON WIRE LINES; L. M. Ilgenfritz, Orange, N. J. App. filed Nov. 20, 1922.

1,543,789. PRINTING TELEGRAPH EXCHANGE SYSTEM; R. D. Parker and G. S. Vernam, Brooklyn, N. Y. App. filed Dec. 23, 1922.

1,543,806. ELECTRIC FIXTURE SWITCH; D. N. Thompson, Syracuse, N. Y. App. filed July 5, 1923.

1,543,813. IMPULSE-GENERATING DEVICE; G. F. Atwood. Newark, N. J. App. filed July 14, 1923. The transmission of uniformly spaced impulses of predetermined characteristics.

1,543,824, 1,543,825. SWITCHING DEVICE; H. F. Dobbin, New York, N. Y. App. filed Oct. 6, 1921. Employed in telephone systems.

1,543,828. COMBINED SHOE TREE AND DRIER; A. G. Doyle, Chicago, Ill. App. filed June 26, 1922.

1,543,836. SIGNALING SYSTEM; J. C. Field, Orange, N. J. App. filed Nov. 26, 1920. Selective; for train despatching.

1,543,854. TELEPHONE-EXCHANGE SYSTEM; L. H. Johnson, Bloomfield, N. J. App. filed Jan. 3, 1921. Machine switching.

1,543,859. RADIUM THERAPEUTIC DEVICE; E. D. Leman, East Orange, N. J. App. filed Oct. 27, 1922.

1,543,861. METHOD OF AND APPARATUS FOR PRODUCING COPPER SHEETS ELECTROLYTICALLY; W. W. McCord, Wyandotte, Mich. App. filed May 16, 1924.

1,543,868. METHOD AND APPARATUS FOR ELECTRICAL REGULATION; F. W. Merrill, East Orange, N. J. App. filed Aug. 24, 1921. Reciprocating booster system which automatically maintains the voltage of a distribution circuit at a desired value.

1,543,866. METHOD OF TESTING SLATE FOR ELECTRICAL PURPOSES; W. R. Notvest, Euclid, Ohio. App. filed May 15, 1923.

1,543,867. REPRODUCER FOR SOUND RECORDS; H. L. Page, Chicago, Ill. App. filed May 3, 1922.

1,543,869. TELEPHONE-EXCHANGE SYSTEM; L. Polmkowsky, New York, N. Y. App. filed June 5, 1919. Automatic.

1,543,872. VACUUM TUBE APPARATUS; S. Ruben, New York, N. Y. App. filed April 13, 1923. For circuit control.

1,543,886. TELEPHONE SYSTEM; H. S. Turner, Brooklyn, N. Y. App. filed Feb. 27, 1915. Trunking systems.

1,543,893. TELEPHONE SYSTEM; S. B. Williams, Brooklyn, N. Y. App. filed March 31, 1923. Automatic.

1,543,900. TESTING SYSTEM FOR AUTOMATIC TELEPHONE SWITCHES; A. S. Bartels, Tenafly, N. J. App. filed July 23, 1923.

1,543,905. LINED CRUCIBLE; M. S. Clawson, Upper Montclair, N. J. App. filed July 9, 1923. For use with electric furnaces.

1,543,906. TELEGRAPHIC RECEIVING APPARATUS FOR PRODUCING PUNCHED TAPE; F. G. Creed, Croydon, England. App. filed June 18, 1923.

1,543,908. METHOD OF OPERATING ELECTRIC FURNACES; W. Dyrssen, New York, N. Y. App. filed March 30, 1922. Control of the power input.

1,543,914. TELEPHONE SWITCH; H. W. Goff, New York, N. Y. App. filed May 1, 1923. Automatic switch of the co-ordinate type.

1,543,927. CUT-OUT ASSEMBLY; O. Kersten, Highland Park, Mich. App. filed Oct. 14, 1921. For battery-charging systems.

1,543,928. ELECTRICAL DEHYDRATOR; R. E. Land, Houston, Tex. App. filed Aug. 4, 1923.

1,543,933. TESTING DEVICE FOR TELEPHONE EXCHANGE SYSTEMS; E. R. Lundius, Brooklyn, N. Y. App. filed May 8, 1923.

1,543,937. AUTOMATIC TELEPHONE EXCHANGE SYSTEM; J. L. McQuarrie, New York, N. Y. App. filed Nov. 28, 1921.

1,543,938. ELECTRIC STOVE HEATER ELEMENT; R. H. MacInnes, Hamilton, Ontario, Can. App. filed Feb. 9, 1925.

1,543,952. ELECTRIC SWITCH; C. D. Platt, Bridgeport, Conn. App. filed Jan. 10, 1925. Enclosed safety switch having a quick-break mechanism.

1,543,967. TELEPHONE EXCHANGE SYSTEM; S. B. Williams, Brooklyn, N. Y. App filed June 13, 1923. Automatic.

1,543,981. ELECTRICAL SYSTEM OF DISTRIBUTION; W. F. Bouche, Lancaster, N. Y. App. filed Jan. 21, 1922. Using generator-storage-battery arrangement.

1,543,990. ELECTRICAL MEANS FOR PRODUCING MUSICAL NOTES; L. De Forest, New York, N. Y. App. filed April 24, 1915.

1,543,992. TELEPHONE TRANSMITTER AMPLIFIER AND REPEATER; H. H. Dunwoody, Washington, D. C. App. filed Oct. 25, 1924.

1,543,994. INDUCTOMETER; J. G. Ferguson, Brooklyn, N. Y. App. filed Dec. 18, 1923. Having a small stray field.

1,543,998. CONNECTION OF ELECTRIC CONDUCTORS; E. Gindre, Levallois-Perret, France. App. filed April 14, 1924. In a carbon or graphitic composition.

1,544,001. ELECTROSTATIC REPRODUCER FOR TALKING MACHINES AND THE LIKE; N. Groenebaum, Neu-Babelsberg, near Berlin, Germany. App. filed Jan. 3, 1925.

1,544,010. GENERATOR OF ELECTRIC CURRENT; E. Jordan, Paris, France. App. filed April 24, 1923. In which current is generated directly by the reciprocation of a moving piston actuated by the expansion of a fluid.

1,544,027. PLATING DEVICE; J. J. Mueller, Jr., Ottawa, Ill. App. filed Feb. 1, 1923.

1,544,044. PROCESS OF AND APPARATUS FOR AUTOMATIC ELECTRIC ARC WELDING; A. Smith, San Mateo, Cal. App. filed March 24, 1919.

1,544,052. METHOD OF AND APPARATUS FOR PURIFYING LIQUIDS; M. D. Avery, Chicago, Ill. App. filed Jan. 19, 1923.

1,544,081. TRANSMITTING INTELLIGENCE BY RADIANT ENERGY; F. K. Vreeland, Montclair, N. J. App. filed Jan. 2, 1907.

1,544,089. SAFETY SWITCH AND FUSE BOX; C. L. Eidlitz, New York, N. Y. App. filed Aug. 14, 1919.

1,544,102. ARC GENERATOR; P. O. Pedersen, Fredericksberg, near Copenhagen, Denmark. App. filed June 21, 1919. For increasing the constancy of the oscillations and the efficiency in producing high frequency currents.

1,544,106. SWITCH HOUSING STRUCTURE; W. M. Scott, Tredyffrin Township, Chester County, Pa. App. filed Oct. 2, 1919.

1,544,113. ALTERNATING CURRENT INDUCTION MOTOR; T. Torda, Budapest, Hungary. App. filed June 7, 1922. Compensated for phase displacement.

1,544,127. METHOD AND ARRANGEMENT FOR DETERMINING CROSSTALK IN MULTI-CIRCUIT SYSTEMS; F. Breisig, Berlin, Germany. App. filed Aug. 13, 1921.

1,544,137. DEVICE FOR PROTECTING ELECTRICAL CIRCUITS FROM OVERHEATING; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed Jan. 21, 1925.

1,544,138. PROTECTIVE DEVICE FOR ELECTRIC CURRENT CONSUMING APPARATUS; O. Dreyer, Essen-on-the-Ruhr, Germany. App. filed April 25, 1924. Thermostat.

1,544,151. METHOD OF AND APPARATUS FOR FORMING CONTINUOUS ELECTRODES; A. Helfenstein, Vienna, Austria. App. filed March 20, 1923.

1,544,156. TRANSMITTING PICTURES BY WIRELESS; C. F. Jenkins, Washington, D. C. App. filed March 13, 1922.

1,544,157. RADIO RECEIVING DEVICE; C. F. Jenkins Washington, D. C. App. filed Sept. 11, 1922.

1,544,158. WIRELESS BROADCASTING OF PICTURES; C. F. Jenkins, Washington, D. C. App. filed Sept. 11, 1922.

1,544,159. ELECTRIC WATER HEATER; F. C. Jento, Hamilton, Ontario, Canada. App. filed April 24, 1923. May be made either portable or stationary.

1,544,188. PLATING BARREL; J. W. Slattery, Bridgeport, Conn. App. filed Oct. 29, 1923.

1,544,191. PORTABLE ELECTRIC SEARCHLIGHT; R. L. Smith, Belmont, Mass. App. filed Feb. 21, 1924.

1,544,201. WELDING PROCESS; C. B. Waters, Montclair, N. J. App. filed Aug. 16, 1924.

Financial and Corporate

Utility Stocks Improve

Southeastern Power & Light Is Leader as Shares Jump 25 Points in Week

WHILE the general trend of power and light stocks continued upward last week, improvement was not spectacular except in the case of one or two issues. Conditions continued to favor bullish movements for industrial and railroad issues and these same constructive forces aided the rise in utilities.

Nowhere in the whole power and light list, however, was there to be found a movement so spectacular as that in Southeastern Power & Light Company's stock. The old Alabama Traction, Light & Power stock, which late last year was split on a two to one basis into the new Southeastern, sold between 30 and 40 in 1924. Southeastern subsequently sold at the same level, but last week touched 156. In other words, stock that could have been bought last year at 30 now has reached a level equivalent to 312. Publication of the company's initial annual report, progress with the Cherokee project, by which the utility expects greatly to enlarge its power capacity, and persistent rumors about merger possibilities are what stimulated trading activity. It is also expected that the company will, through numerous additions of properties and growth, about double its gross revenues in 1925 as against 1924.

North American Company's stock was a leader among the listed issues and moved into new high territory around 60 on buying stimulated by the company's continued improvement in earnings position. The new income statement for the June quarter shows that the system's gross earnings now have crossed the $82,000,000 mark, placing the utility in the front rank of prominent power and light holding companies of the country. Havana on the big board also made a new top above 194 on persistent rumors that this Cuban utility is being bought for control. Better prices for the week were recorded by such issues as Carolina Power & Light, Electric Investors, Lehigh Power Securities, Mississippi River Power, National Power & Light and losses by General Gas & Electric, Adirondack Power & Light and American Public Utilities.

Light and Power Securities Legal Bank Investments

The Bank Commissioner of the State of Maine has prepared a new list of securities which he considers legal investments for the savings banks of the state as of May 1, 1925. Securities of the following light and power companies were included in the eligible list: Alabama Power and subsidiaries, Appalachian Power, Arkansas Light & Power, Asheville Power & Light, Baton Rouge Electric, Binghamton Light, Heat & Power, Brooklyn Edison and subsidiaries, Buffalo General Electric, Carolina Power & Light, Central Georgia Power, Central Illinois Light, Cleveland Electric Illuminating, Columbus Electric & Power and subsidiary, Commonwealth Edison and subsidiary, Connecticut Light & Power and subsidiary, Connecticut Power and subsidiaries, Consolidated Gas, Electric Light & Power of Baltimore and subsidiaries, Consumers Power and subsidiaries, Dayton Power & Light and subsidiary, Detroit Edison and subsidiary, Duquesne Light, Eastern Wisconsin Electric and subsidiary, East Penn Electric and subsidiaries, Elmira Water, Light & Railroad, Empire District Electric, Empire Gas & Electric, Erie County Electric, Great Western Power of California and subsidiaries, Harrisburg Light & Power, Houghton County Electric Light, Idaho Power, Indiana Service, Kansas City Power & Light, Keystone Power, Lockport Light, Heat & Power, Long Island Lighting and subsidiary, Los Angeles Gas & Electric and subsidiaries, Luzerne County Gas & Electric and subsidiaries, Manchester Traction Light & Power, Metropolitan Edison and subsidiary, and the Mississippi River Power.

Certain securities of the following utilities also met the requirements: Nebraska Power, New England Power, New Jersey Power & Light, New York Central Electric, Newport News & Hampton Railway, Gas & Electric and subsidiaries, New York Edison and subsidiaries, New York State Gas & Electric, Northen New York Utilities, Inc., Northern States Power, Ohio Power, Ohio Public Service and subsidiaries, Pacific Gas & Electric and subsidiaries, Pennsylvania Edison, Pennsylvania Power & Light and subsidiaries, Philadelphia Electric and subsidiaries, Pine Bluff Company, Potomac Electric Power, Public Service of Northern Illinois and subsidiaries, Puget Sound Power & Light and subsidiaries, Queens Borough Gas & Electric and subsidiaries, San Diego Consolidated Gas & Electric, San Joaquin Light & Power, Seattle Lighting, Southern California Edison and subsidiaries, Southern Public Utilities and subsidiaries, Syracuse Lighting, Tidewater Power, Topeka Edison, Turners Falls Power & Electric, Washington Coast Utilities, Washington Water Power, Western New York Utilities, West Penn Power, Wisconsin Gas & Electric and the Yadkin River Power.

Buffalo, Niagara & Eastern Power Corporation

The accompanying map shows the territory served by the Buffalo, Niagara & Eastern Power Corporation, which has received the approval of the Public Service Commission to acquire the controlling interest of the Niagara Falls Power Company, Niagara, Lockport & Ontario Power Company, Buffalo General Electric Company, and the Tonawanda Power Company. The map indicates that this system has one of the most strategic locations for the generation, transmission and distribution of power in the world, due to the extensive industrial territory covered, population served and large number of customers. The zone served by Niagara Power is roughly three hundred miles from east to west and one hundred miles from north to south; that is, from Erie, Pa., to and beyond Syracuse, N. Y., and from Niagara frontier to Bradford, Pa. This territory includes eighteen counties in western and central New York, and one county in Pennsylvania. Within this region two million people are served with light and power.

TERRITORY SERVED BY BUFFALO, NIAGARA & EASTERN POWER CORPORATION

More important than the large number of people or the extensive territory served is the exact character of the territory and population. The nature of the industry is extremely important,

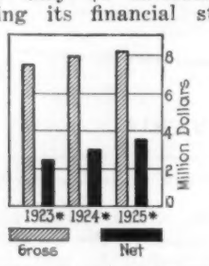
as affecting the demand for power and the power load factor. At Niagara, the electro-chemical center of the world, the particular nature of the industry requires constant and reliable twenty-four-hour supply of power, which results in a very high load factor. Probably nowhere else in the country are the power generating facilities used to so full an extent of their capacities as they are in this particular region, due entirely to the steady requirements of the electro-chemical industry. In Buffalo and the territory extending beyond Syracuse the diversification of industry assures a constant and increasing demand for power. Due to this great diversification of manufacturing processes a more uniform load factor is obtained not only throughout the day but in general throughout the year. The great demand for electricity for power and lighting purposes is so rapidly increasing, and in fact exceeding the capacities of the separate companies operating independently, that the Buffalo, Niagara & Eastern Power Corporation has been formed to meet these vital economic needs by rendering a more constant service.

Metropolitan Edison Takes Step Ahead

By Marketing 135,000 Shares of New Preferred Stock, One of the Largest Issues Ever Sold, Company Plans to Retire Three Capital Issues

BY PAUL WILLARD GARRETT

THE Metropolitan Edison Company's recent sale of 135,000 shares of series C preferred stock, representing one of the largest offerings of a straight power and light preferred issue ever made, should go a long way in improving the company's capital set-up. The proceeds from the sale of this stock are to be used to retire issues already outstanding but which require larger payments relatively than will be required as dividends for the new stock. The new series C stock is entitled to cumulative dividends at the rate of $6 a share. It will replace (1) the entire outstanding series A ($7 dividend) participating preferred stock; (2) all of the outstanding series A 8 per cent bonds of the company, and (3) part of the proceeds also will be used for advances to the Pennsylvania Edison Company, a subsidiary, to call the latter's entire outstanding $8 preferred stock on October 1, 1925. That the system is getting rid of these high-coupon and high-dividend bearing issues through flotation of a junior issue entitled to only $6 dividends, thus strengthening its financial structure,



OPERATING REVENUE OF THE METROPOLITAN EDISON SYSTEM

(*Year ended May 31.)

marks a step forward for Metropolitan Edison.

The Metropolitan Edison Company easily is the most important subsidiary in the General Gas & Electric system and its properties form an integral part of the Boston-Washington zone of the super-power survey made for the Department of the Interior. In addition to properties owned directly the Metropolitan Edison Company controls through ownership of the entire outstanding capital stocks the Pennsylvania Edison Company, the Hanover Power Company, the Gettysburg Electric Company, York Haven Water & Power Company, Cumberland Valley Light & Power Company and the Metropolitan Power Company. The territory in which the Metropolitan Edison Company and its subsidiaries supply electric light and power includes numerous active industrial centers of eastern Pennsylvania, among which may be named Reading, York, Lebanon and Easton.

The capitalization of the company upon completion of the present financing will be as follows: Bonds will be outstanding to the amount of $27,599,800 and capital stock to the amount of 281,942 shares. Subsidiary bonds, to segregate the above figures, will total $15,951,800 and Metropolitan Electric Company mortgage 5s of 1939 will total $2,418,000. Series B mortgage bonds of the Metropolitan Edison Company will total $6,080,000 and the series C bonds of the same mortgage $3,150,000. There will be two series of preferred stocks, the 17,100 shares ($7 dividend) known as series B and the new issue of 135,000 series B stock ($6 dividend). Common stock will be outstanding to the amount of 129,842 shares.

Both gross and net earnings are growing steadily and have reached the highest levels in the history of the company. In the twelve months ended May 31, 1925, gross operating revenue and other income totaled $8.406,576 and net income reached $3,523,668. Income available for payment of the preferred dividends, after deductions for interest and amortization on funded debt, maintenance and depreciation, amounted to $1,996,463 in the twelve-month period under review or enough to cover annual dividend requirements on the preferred stocks more than twice. Appropriations for maintenance and depreciation in the same period aggregated 18 per cent of the total operating revenue.

President E. L. West recently had the following to say about the valuation of the company's properties: "The value of the company and its subsidiary companies' valuation of principal properties based on independent engineers' reports is in excess of $52,600,000. Adding to this valuation the amount of net current assets of the company and its subsidiaries and its investment in an associate company, and after allowing for the amount of the company's and its subsidiaries' outstanding funded debt (less the $1,593,000 8 per cent bonds to be called) the balance is equivalent to more than $188 per share of preferred stock to be outstanding upon completion of this financing."

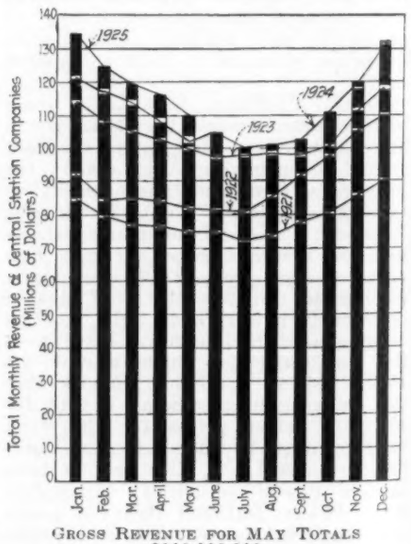
Company Reports

The following statements of earnings were issued during the past week by electric light and power companies for the month of June:

Name of Company	Gross Earnings for June 1925	1924
Alabama Power	$928,069	$705,184
Bangor Hydro-Electric	115,746	112,195
Central Illinois Light	284,043	242,957
Columbia Gas & Electric	2,521,798	1,656,551
Commonwealth Power	3,430,382	2,949,539
Consumers Power	1,581,686	1,385,079
Georgia Railway & Power	1,389,370	1,291,823
Great Western Power	640,839	627,830
Massachusetts Lighting Cos.	288,671	272,387
Newport News & Hampton Ry., Gas & Elec.	188,102	176,117
Northern Ohio Power	927,811	793,014
Ohio Edison	111,881	107,463
Philadelphia Co. & Affil. Corp.	4,541,321	4,464,981
Portland Electric Power	905,471	850,181
Public Service Corp. of N. J.	7,318,522	6,930,270
Republic Railway & Light	870,153	810,232
Southern Indiana Gas & Elec.	201,479	205,566
Tennessee Electric Power	962,016	755,198
United Gas & Electric	1,100,373	1,045,185
Virginia Railway & Power	856,811	837,913

May Revenue 9.0 per Cent Over Last Year

Reports received by the ELECTRICAL WORLD from central-station systems representing 77 per cent of the generator rating of the industry indicate that the total gross revenue from the



GROSS REVENUE FOR MAY TOTALS $110,900,000

sale of energy during May was $110,900,000, or a daily average of $3,580,000, an increase of 9.0 per cent over May of last year. During May the gross revenue was 5.3 per cent below the estimated normal for that month, this normal being based on the operations for the past five years.

The operating expenses during May totaled $51,250,000, a gain of 7.3 per cent over May of last year and compare with $51,750,000, the figure recorded for April.

Dividends Declared

The quarterly dividends listed below were announced during the past week by electric light and power companies and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
Brazilian Traction Lt. & Pwr. ord.	1	Sept. 1
Con. Gas El. L. & Pr. of Balti., com.	.50	Oct. 1
Con. Gas El. L. & Pr. of Balti., 8% pf.	2	Oct. 1
Con. Gas El. L. & Pr. of Balti., 7% pf.	1¾	Oct. 1
Con. Gas El. L. & Pr. of Balti., 6½% pf.	1⅝	Oct. 1
Con. Gas El. L. & Pr. of Balti., 6% pf.	1½	Oct. 1
Consolidated Utilities, pf.	1¾	Aug. 1
Eastern Shore Gas & Elec., pf.	2	Sept. 1
National Power & Light, com.	$1.50	Sept. 1
Newport News & Hampton, Ry., Gas & Elec., pf.	1¾	Oct. 1
Pacific Gas & Elec., pf.	1½	Aug. 15
Pacific Lighting, com.	2½	Aug. 15
Pacific Lighting, pf.	1¾	Aug. 15
Penn. Central Lt. & Pwr., pf. extra.	.10	Oct. 1
Penn. Central Lt. & Pwr., pf.	$1	Oct. 1
Phila. Suburban Gas & Elec., pf.	1¾	Aug. 1
Portsmouth Power, pf.	1¼	Aug. 1
Ingersoll-Rand, com.	2	Sept. 1

Aluminum Company to Merge with Canadian Power Company. — Stockholders of the Aluminum Company of America at a meeting in Pittsburgh this week approved the proposed merger of the company with the Canadian Manufacturing & Development Company. The consolidation was also approved by the stockholders of the Canadian company. Early in the week the stockholders of the Aluminum Company approved a reduction in the par value of the company's stock from $100 to $5 a share. The stock of reduced par value will be exchanged for the capital shares of the new company which will be formed from the merger.

Annual Report of United Power & Light Corporation.—The annual report of the United Power & Light Corporation for the year ended December 31, 1924, shows gross revenue amounting to $2,848,265 as compared with $1,288,804 for the previous year. Total assets aggregated $17,121,416, against $10,857,924 in 1923. At the end of the year the company had on its lines 30,760 electric customers, to whom it furnished 61,356,222 kw.-hr. The present corporation is a reorganization and consolidation of twelve former companies.

Utility Companies in Two Mergers.—Mergers of public utility companies through the acquisition of properties in Oklahoma and West Virginia by H. M. Byllesby & Company and the Monongahela West Penn Public Service Company were announced during the past week. The Byllesby organization has taken over from the Clement Studebaker interests the properties of the Consumers Light & Power Company, supplying electric, natural gas and other services in seventeen municipalities in the southern part of Oklahoma, having a population of more than 40,000. By purchasing control of five companies in West Virginia, the Monongahela West Penn Public Service Company is planning to extend the superpower system that now links the industrial area in southwestern Pennsylvania and northern and central West Virginia. The added properties are: Brooks Electric Company, West Virginia & Maryland Power Company, Parsons Electric Company, West Virginia Public Service Company and the St. Mary's Power & Light Company.

New Capital Flotations in July Totaled $70,488,510

DURING the month of July new offerings of stocks, bonds and notes of electric light and power companies amounted to $70,488,510 — a moderate figure in comparison with that recorded for the month of June, when securities totaling $96,495,500 were sold. Twenty-seven utilities participated in the new financing during July, but the offerings were of limited volume. Eleven issues were under the one-million-dollar mark and only two exceeded $5,000,000. The largest individual offering was made by the Metropolitan Edison Company in the form of preferred stock to the amount of $12,825,000, priced at $95 per share to yield 6.31 per cent. The average yield, which fell sharply in June to 6 per cent, advanced in July to 6.15 per cent.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN JULY

Name of Company	Amount of Issue	Period Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Toledo Traction, Lt. & Pwr. Co. (O.)	$8,500,000	5	Secured gold notes	To obtain funds for purchase of control of other utility	5½	99	5.73
Western United Corp. (Ill.)	1,500,000	5	Collateral gold notes, series E	To retire debentures and for other corporate purposes	5½	100	5.50
Central Indiana Power Co. (Ind.)	5,000,000	3	Collateral gold notes, series A	Refunding and to reimburse for expenditures on additions and improvements	6	100	6
Carolina Mountain Power Co. (No. Car.)	550,000	10	First mortgage gold bonds	Construction	6	97	6.40
Fall River Electric Light Co. (Mass.)	2,000,000	20	First mortgage gold bonds, series A	To pay off floating debt and for purchase of stock of other company	5	107.92	4.40
Lawrence Gas & Electric Co. (Mass.)	1,500,000	15	First mortgage gold bonds, series B	Refunding	4¼	101.64	4.35
Michigan Public Service Co. (Mich.)	500,000	1	Gold notes	To pay for purchase of properties and for construction	6	99¾	6.37
Middle West Utilities Co. (Ill.)	2,500,000	..	Preferred stock	Acquisition of new properties and for other general corporate purposes	7	96¼	7.25
Quebec Power Co. (Que.)	1,000,000	..	Cumulative preferred stock	To meet necessary capital expenditures and for the general purposes of the company	7	105	6.67
Calumet Gas & Electric Co. (Ind.)	2,700,000	35	First and refunding mortgage gold bonds, series B	To retire bonds outstanding on properties recently acquired, to reimburse for capital expenditures, to acquire new properties and for construction	5½	98½	5.60
Long Island Lighting Co. (N. Y.)	3,500,000	20	Secured gold bonds	To acquire stock of another company	6	100	6
	400,000	11	First mortgage sinking fund gold bonds		5	100	5
	689,010	...	Cumulative preferred stock		7	105	6.66
Broad River Power Co. (So. Car.)	1,400,000	..	Cumulative preferred stock	Construction	7	95	7.37
Southwestern Light & Power Co. (Okla.)	742,500	..	Cumulative preferred stock		6	82½	7.27
National Electric Power Co.	3,325,000	..	Participating stock, class A		..	23.75	7.57
	3,000,000	20	Secured gold bonds		6	97	6.25
Lake Shore Power Co. (O.)	845,000	25	First and refunding mortgage gold bonds, series A	Additions	6	99	6.07
Western Reserve Power & Light Co.	200,000	20	First mortgage sinking fund gold bonds	To pay for consolidation of properties	6	100	6
Central States Power & Light Corp.	500,000	5	Secured gold bonds	Additional working capital	6	100	6
Tennessee Eastern Electric Co.	400,000	30	Refunding mortgage gold bonds, series A	Construction	6	98	6.15
Southwestern Gas & Electric Co. (Ark.)	1,834,000	..	Cumulative preferred stock	Construction	7	96	7.29
Iowa Southern Utilities Co.	3,000,000	25	First and refunding mortgage gold bonds	To reimburse for additions, for improvements and for other corporate purposes	5½	97½	5.70
Metropolitan Edison Co. (Pa.)	12,825,000	..	Preferred stock, series C	Refunding	6	95	6.31
Lexington Utilities Co. (Ky.)	653,000	21	First mortgage and refunding gold bonds, series C	Construction	6	99	6.08
Androscoggin Water Power Co. (Me.)	1,500,000	20	First mortgage gold bonds	To reduce current liabilities of affiliated company and for its other corporate purposes	6	99½	6.04
Associated Gas & Electric Co. (N. Y.)	1,000,000	...	Preferred stock		7	100	7
Melones Dam Hydro-Electric Power Development	1,100,000	2-40	Gold bonds	Construction	5	..	4.50
	900,000	2-37	Gold bonds		5	..	to 4.75
Southern Colorado Power Co.	3,025,000	—	Common stock, class A	Refunding	3	27½	....
General Gas & Electric Corp.	3,900,000	...	Cumulative preferred stock, class A	Refunding	7	97½	7.18
	Total $70,488,510						

Stock and Bond Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stocks is $100.)

Companies	Bid Price Saturday, July 25	Low 1925	High 1925
PREFERRED STOCKS			
Operating Companies			
Adirondack Pwr. & Lt.—7%	100	98	106
Adirondack Pwr. & Lt.—8%	108	103	115
Appalachian Pwr.—7%	98	92	100
Appalachian Pwr. 1st pf.—7%	100	95	101
Arizona Pwr.—7%	83	75	87
Arkansas Lt. & Pwr.—7%	97	92	102
Asheville Pwr. & Lt.—7%	f101½	101	102½
Central Ill. Pub. Serv.—6%	85	84	93
Cleveland Elec. Illg.—6%	102	101	105
Colo. Pwr.—7%	94	93	98
Conn. Lt. & Pwr.—8%	115	115	118
Conn. Lt. & Pwr. —7%	106	105	110
eCon. Gas, El. Lt. & Pwr.—6½%	110	105	110½
Cons. Gas, El. Lt. & Pwr.—8%	124	123	126
Cons. Gas, El. Lt. & Pwr.—7%	109	108	112
Consumers' Pwr.—6%	94	90	97
Dayton Pwr. & Lt.—6%	95	88	100
Dubuque Elec.—6%	89	80	90
Duquesne Lt.—7%	110½	105	111¾
East. Tex. Elec.—6%	100	100	105
Empire Dist. Elec.—6%	78	78	85
Ft. Worth Pwr. & Lt.—7%	f102	101½	103
Georgia Ry. & Pwr.—4%	90	62	90
Gt. West. Pwr.—7%	101	....	....
Ia. Ry. & Lt.—7%	97	92	100
Ill. North. Utilities—6%	88	82	92
Ill. Pwr. & Lt.—7%	95½	92½	98
Interstate Pub. Serv.—7%	95	90	100
Kans. Gas & Elec.—7%	f102	101½	103
Long Island Lighting—7%	103	100	105
Los Angeles Gas & Elec.—6%	95	90	95
Milwaukee Elec. Ry. & Lt.—8%	100	98	105
Milwaukee Elec. Ry. & Lt.—7%	97½	96	105
Milwaukee Elec. Ry. & Lt.—6%	86	83½	87
Minn. Pwr. & Lt.—7%	f100	100	101
Miss. River Pwr.—6%	92	87½	94
Nebraska Pwr.—7%	f102½	102	103½
N. J. Pwr. & Lt.—7%	97	92	98
New Orleans Pub. Serv.—7%	100½	94	102
N. Y. Central Elec.—7%	98½	96	100
Niagara Falls Pwr.—7%—25	27¼	28	29
Niagara, Lock. & Ont. Pwr.—7%	107	101½	110
No. Caro. Pub. Serv.—$7—no par	91	90	96
No. Ohio Trac. & Lt.—6%	73	64	75
North. States Pwr.—7%	98	95	100
Ohio Gas & Elec.—7%	90	87	100
Ohio Pwr.—6%	92	85	95
Ohio Pub. Serv.—7%	98	97	100
Pac. Gas & Elec.—6%	98	92	99
Pac. Pwr. & Lt.—7%	f101½	101	102½
cPenn Central Lt. & Pwr.—no par	69	60	69¾
Penn-Ohio Pwr. & Lt.—7%	94	91	100
Penn-Ohio Pwr. & Lt.—8%	106	101	110
Penn. Pub. Serv.—7%	90	90	100
Penn Pub. Serv.—6%	80	80	90
Penn. Pwr. & Lt.—$7—no par.	104	99½	105
cPhila. Elec.—8%—25	37½	37½	45
Portland Elec. Pwr.—7%	98	95	99
Portland Elec. Pwr.—6%	75	70	80
Pwr. Corp. of N. Y.—7%	98	96	102
Pub. Serv. of No. Ill.—6%	108	90	97
Pub. Serv. of Okla.—7%	94	87	95
Pub. Serv. Elec. & Gas—6%	f 95	92½	95¾
Puget Sound Pwr. & Lt.—7%	102	102½	107
Rochester Gas & Elec.—5%	105	80	98
So. Calif. Edison—8%	125	115	128
So. Calif. Edison—7%	107½	105	107½
So. Calif. Edison—6%	99	90	95½
Tenn. Elec. Pwr.—6%	85	80	85
Tenn. Elec. Pwr.—7%	98½	93	103
Tenn. Elec. Pwr.—$6—no par	81	72	84
Tex. Pwr. & Lt.—7%	f102½	102	104
Toledo Edison—8%	110	109	114
Toledo Edison—7%	100	94	101½
Utah Pwr. & Lt.—7%	f100½	100	101½
Utica Gas & Elec.—7%	101	100	104
Vermont Hydro-Elec.—7%	90	87	96
Virginia Pwr.—7%	102	94	107
West Penn—7%	98½	94	100
West. States Gas & Elec.—7%	89	82	92
Wis.-Minn. Lt. & Pwr.—7%	95	92	95
Yadkin River Pwr.—7%	f102	102	103
Holding Companies			
Amer. & Foreign Pwr.—7%	f 90½	87	94
Amer. Gas & Elec.—6%—no par	89	85	91
Amer. Lt. & Trac	101	93	101½
Amer. Pwr. & Lt.—6%	93	84	91½
Amer. Pub. Serv.—7%	90	88	94
Amer. Pub. Utilities—5%	80	71	82
Amer. Pub. Utilities—7%	91	87	95
Amer. Water Wks. & Elec.—6%	g110½	95½	110½
Amer. Water Wks. & Elec.—7%	f 99¼	99	103
Assoc. Gas & El.—7%—1% extra—50	f 52	....	....
Assoc. Gas & Elec.—$6—no par	84	....	....
Carolina Pwr. & Lt.—$7—no par	105	100	107
Central Ark. Ry. & Lt.—7%	97	91	98½
Central Ind. Pwr.—7%	90	88	95
Central States Elec.—7%	93	87	98
Cities Serv.—6%	82	80	83
Columbia Gas & Elec.—7%	110	104½	110½
Commonwealth Pwr.—6%	80	80	85½
Continental Gas & Elec.—7% pfc. pf	94	85	97
Continental Gas & Elec.—7% pr. pf	92½	89	95
Elec. Bond & Share—6%	f104	104	106
Elec. Investors—7%	99	90	100
Elec. Pwr. & Lt., ctfs.	f 91¾	90	94
Elec. Pwr. & Lt., ctfs. 40% pd.	f110	100	110
Galveston-Houston Elec.—6%	70	70	75
Gen. Gas & Elec.—6%	235	72	240
Gen. Gas & Elec.—7%	150	120	....
Gen. Gas & Elec.—$7—no par	155	90	175
Gen. Gas & Elec.—$8—no par	168	104½	180
Georgia Lt., Pwr. & Rys.—6%	80	74	85
Jersey Central Pwr. & Lt.—7%	97	90	96
aMiddle West Utilities—7%	97	91½	98¾
Middle West Utilities—pr. lien 7%	101	98	108
Natl. Lt., Ht. & Pwr.—5%	62	40	65
Natl. Pwr. & Lt.—$7—no par.	101	95	99
No. Amer.—6%—50	f 49¾	46¾	50¾
No. Tex. Elec.—6%	55	60	75
Penn-Ohio Elec.—7%	94	83½	96
Phila. Co.—50	48½	45½	49
Pub. Serv. Corp. of N. J.—7%	f102	99	102½
Pub. Serv. Corp. of N. J.—8%	114½	108¾	115¾
Southeastern Pwr. & Lt.—7%	98	90	100
Southern Cities Utilities—7%	87	77	100
Southwestern Pwr. & Lt.—7%	100	90	102
Standard Gas & Elec.—8%	f 54	50¾	54½
Standard Gas & Elec.—7%	99	96	100
Standard Pwr. & Lt.—7%	112	95	114½
United Gas & Elec.—5%	91	80	94
cUnited Gas Improv.—50	88½	79½	96½
United Lt. & Pwr.—$4—no par	50	41	51
United Lt. & Pwr.—$6.50—no par	87	83	99
Western Pwr. Cor.—7%	94	84	95½
COMMON STOCKS			
Operating Companies			
Adirondack Pwr. & Lt.—50	91	31	98
Appalachian Pwr.—no par	79	80	83
Arizona Pwr.	29	15	33
Arkansas Lt. & Pwr.	100	65	101
Brooklyn Edison	f137¾	120¾	140¾
Buffalo Gen. Elec	73	44	73¾
Cleveland Elec. Illg.	240	200	200
aCommonwealth Edison	136	130½	141¾
cConsol. Gas, Elec. Lt. & Pwr.	43¾	32	45
Dayton Pwr. & Lt.	420	180	460
Detroit Edison	f132¾	110	132¾
Eastern Tex. Elec.	70	70	7½
dEdison Elec. Illum. of Boston	209½	200	213
Georgia Ry. & Pwr.	96	62	99
Long Is. Light	105	60	105
Miss. River Pwr.	64	37	68
Montana Pwr.	f 87	64	89¼
New Orleans Pub. Serv.—no par	33	31	38½
Niagara Falls Pwr.—no par	68	43	70
Niagara, Lock. & Ont. Pwr.—no par	65	60	73
North. Ohio Pwr.	12	5	13½
North. States Pwr.	123	103	125
North. Tex. Elec	40	40	70
Pacific Gas & Elec.	f114	102½	118¼
ePenn. Wtr. & Pwr	165	126½	165
cPhila. Elec.—25	38½	37½	47⅞
Portland Elec. Pwr.	42	40	53
Pwr. Corp. of N. Y.—no par	78	15	89¼
Pub. Serv. Co. of No. Ill.	119	97	124
Puget Sound Pwr. & Lt.	51	49	61
So. Calif. Edison	126	102	139
Tenn. Elec. Pwr.—no par	66	47	69
Toledo Edison	25	21	25
Utica Gas & Elec.	200	100	200
Virginia Pwr.	66	65	92
Virginia Ry. & Pwr.	g120½	64½	123
West Penn	f121¼	105	145
Holding Companies			
Amer. & Foreign Pwr.—no par	f 43	27¼	47
Amer. Gas & Elec.—no par	79	70	85
Amer. Lt. & Trac.	170	139	173½
Amer. Pwr. & Lt.	61	52	67
Amer. Pub. Serv.	85	45	90
Amer. Public Utilities	95	70	103
Amer. Wtr. Wks. & Elec.	f 66¾	34⅜	68½
Assoc. Gas & Elec., Class A	f 39¾	....	....
Carolina Pwr. & Lt.—no par	420	290	425
Central States Elec.	99	70	102
Cities Service (new)	38½	34	43
Columbia Gas & Elec.—no par	f 69¼	45¾	69¾
Commonwealth Pwr. Corp—no par	155	106	173
Cons. Gas—no par	f 91¾	74½	92¾
Continental Gas & Elec.	130	77	99
Elec. Bond & Share Sec.	f 68½	68¾	70½
Elec. Investors	62	30	66
Elec. Pwr. & Lt., ctfs.	f 38½	17¾	40½
Federal Lt. & Trac.	f 32¾	30	36
Galveston-Houston Elec.—no par	25	32	40
General Gas & Elec.	235	72	240
Georgia Lt., Pwr. & Rys.	72	25	68
Georgia Ry. & Pwr.	96	62	99
Jersey Central Pwr. & Lt.	45	15	50
Lehigh Pwr. Securities—no par	147	82	131
aMiddle West Utilities—no par	96	82½	102¾
aNational Elec. Pwr.	95¾	95	96¼
Natl. Lt., Ht. & Pwr.	11	11	....
Natl. Pwr. & Lt.—no par	340	185	357
No. Amer.—10	f 60¾	41¾	60½
Phila. Co.—50	f 60¾	51¾	61⅛
Pwr. Securities—no par	12	....	....
Pub. Serv. Corp. of N. J.—no par	f 78⅞	62⅛	78⅛
Republic Ry. & Lt.	64	49	65
Southeastern Pwr. & Lt.	130	45	135
Southern Cities Utilities	53	30	55
Standard Gas & Elec.—no par.	f 56¼	40⅛	57⅜
United Gas & Elec. (Conn.)—no par	49	26	49
United Lt. & Pwr.—A—no par	113	42	117½
United Lt. & Pwr.—B—no par	110	49	100
Western Pwr. Corp.—no par	62	34	68
BONDS			
Operating Companies			
Adir. Pwr. & Lt. 6s 1950	104½	102½	105½
Ala. Pwr. 5s 1946	99½	96	100
Appalachian Pwr. 5s 1941	98½	96	99½
Brooklyn Edison 5s 1949	101¼	99½	103
6s 1930	104½	103½	105½
Cleveland Elec. Illum. 5s 1939	102	100	102
Com'wealth Edison. 5s 1943	101½	99½	102¼
5s 1953	99¾	98½	101
eConsol. Gas Elec. Lt. & Pwr. 6s 1949	107¾	104¾	107¾
Consumers' Pwr. 5s 1936	100	99	100½
5s 1952	97	90½	100
Detroit Edison 5s 1933	101	99½	102½
Duquesne Lt. 6s 1949	106½	104⅝	107½
Great Western Pwr. 5s 1946	98½	95	99¼
Kansas City Pwr. & Lt. 5s 1952	99½	95⅝	101
Miss. River Pwr. 5s 1951	99½	96½	100½
Montana Pwr. 5s 1943	99¼	97⅝	100⅝
New Eng. Pwr. 5s 1951	102½	100½	103
N. Y. Edison 6½s 1941	114⅝	112	115½
Niagara Falls Pwr. 6s 1950	105½	105½	106½
No. States Pwr. 5s 1941	96⅝	93	99⅜
No. States Pwr. 6s 1941	105½	103	107¼
Ohio Pwr. 7s 1951	106½	106½	107¼
Pacific Gas & Elec. 5s 1942	97	93½	99
Penn. Wtr. & Pwr. 5s 1940	100½	99½	102
cPhil. Elec. 5s 1966	103	100½	103½
5½s 1947	106½	103½	107
6s 1941	107	106	108⅛
Portland Elec. Pwr. 6s 1947	99½	96½	100
So. Cal. Edison 5s 1939	99½	99¼	101
6s 1944	104½	102½	105¼
Tenn. Elec. Pwr. 6s 1947	102½	99¼	104¼
Tex. Pwr. & Lt. 5s 1937	98½	97	99½
Toledo Edison 7s 1941	108½	108¾	110
Utah Pwr. & Lt. 5s 1944	95½	91	98½
Holding Companies			
Ala. Trac. Lt. & Pwr. 5s 1962	92½	86	95
Amer. Gas & Elec. 6s 2014	98	96½	98½
Amer. Pwr. & Lt. 6s 2016	97	94	98
Am. Wtr. Wks. & Elec. 5s 1934	95⅜	92½	98
Assoc. Gas & Elec. 6½s 1954	f102½	....	....
Central Ind. Pwr. 6s 1947	98½	95½	99½
Commonwealth Pwr. 6s 1947	101⅛	97⅝	103⅜
Consol. Cities Lt., Pwr. & Tr. 5s 1962	80½	75½	82½
Ill. Pwr. & Lt. 6s 1953	101½	100⅜	102½
United Lt. & Rys. 5s 1932	96¼	93½	97½
6s 1952	99½	95½	100½
ELECTRICAL MANUFACTURING COMPANIES			
PREFERRED STOCKS			
Allis-Chalmers Mfg.	105½	103½	108
bWagner Elec.	79¼	79	81
West. Elec. Instrument—A	f 24½	19⅜	26½
Western Elec.—7%	114	113½	117½
Worthington Pump & Mach.—A	79¾	79	88
Worthington Pump & Mach.—B	64¼	65	76¼
COMMON STOCKS			
Allis-Chalmers Mfg.	f 85	71½	86¾
Amer. Bosch Magneto—no par	f 33½	26½	54½
Elec. Storage Battery—no par	f 65½	60½	70½
General Elec.	f293½	227½	320
General Elec.—10	f 11¾	11	11¾
aHurley Machine—no par.	48½	41⅝	56
Timken Roller Bearing	f 43½	37½	46½
bWagner Elec.	32½	26½	50
Westghse. Elec. & Mfg.—50	f 73¼	66½	84
West. Elec. Instrument	f 15¾	9½	17½
Worthington Pump & Mfg.	f 42	36½	79¼
BONDS			
General Elec. 3½s 1942	87	83	86
5s 1952	107½	101½	107⅜
Robbins & Myers 7 1952	65⅜	63½	73½
Western Elec. 5s 1944	99⅜	98	101
Westghse. Elec. & Mfg. 7s 1931	106⅜	106½	108½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore. fBid price, low and high, Tuesday, July 28. gLatest quotations available.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Electricity and the National Economic Position

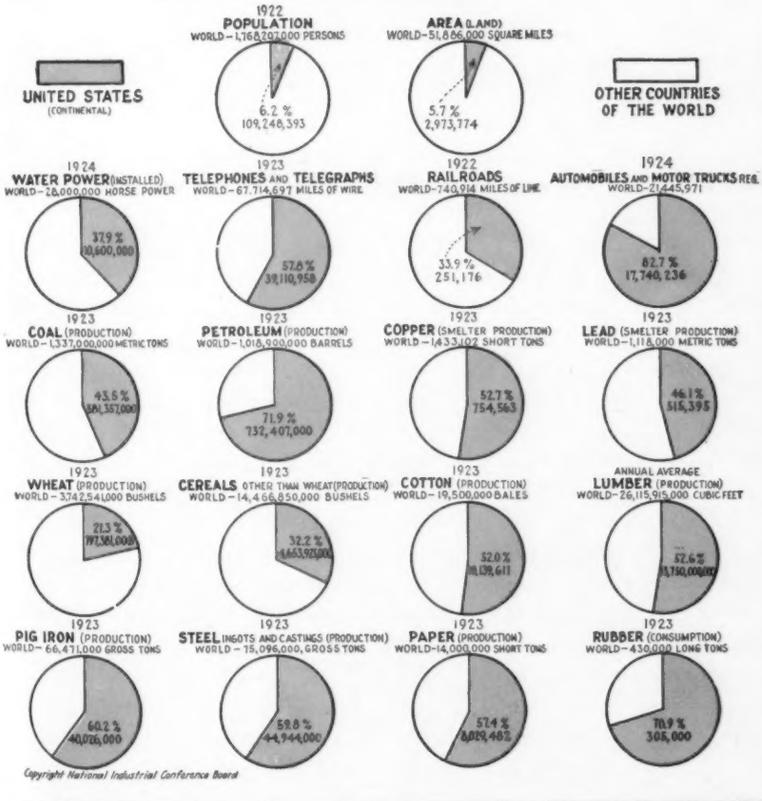
IN KEEPING pace with the activities within the electrical industry in the United States it is well to pause and survey the progress of other primary industries, and to ascertain the present economic position occupied by our own great country in the family of nations. The accompanying diagrams tell a story of superiority and national strength which is overwhelmingly in favor of the United States. Only in population, area and the production of wheat do the combined nations of the world make a showing of real strength, and even in the wheat production more than one-fifth is produced in the United States.

But the United States also leads in the production of still another product, a product not shown in the diagram of the National Industrial Conference Board, and yet a product which has done more in the past ten years to place this nation in its present position of economic leadership than any other factor. Here is a nation with less than 7 per cent of the population of the world, but which consumes more electrical energy for light, heat, power and transportation than all the rest of the world combined. Here is a nation with less than twice the population of Germany, yet with a central-station industry which generates eight times more electrical energy than does the central-station industry of Germany, having eight times more customers, and a total generator rating six times that of Germany.

The answer to America's present economic superiority is America electrified, not an America of pre-war conditions, but an America which has drawn into her being a life-giving fluid which has permeated into every branch of the social and industrial structure, and which has made war efficiency and economy a permanent condition in the industrial and home life of the country. The great strides in electrically operated machinery, in illumination and in the reliability necessary for super-production during the war period created but a desire for more of this heretofore unappreciated servant of industry. So that it may truly be stated that, as a result of the proficiency displayed by the electric light and power companies in meeting war conditions, the industry really entered into its own at the close of the war and electrified America assumed economic leadership.

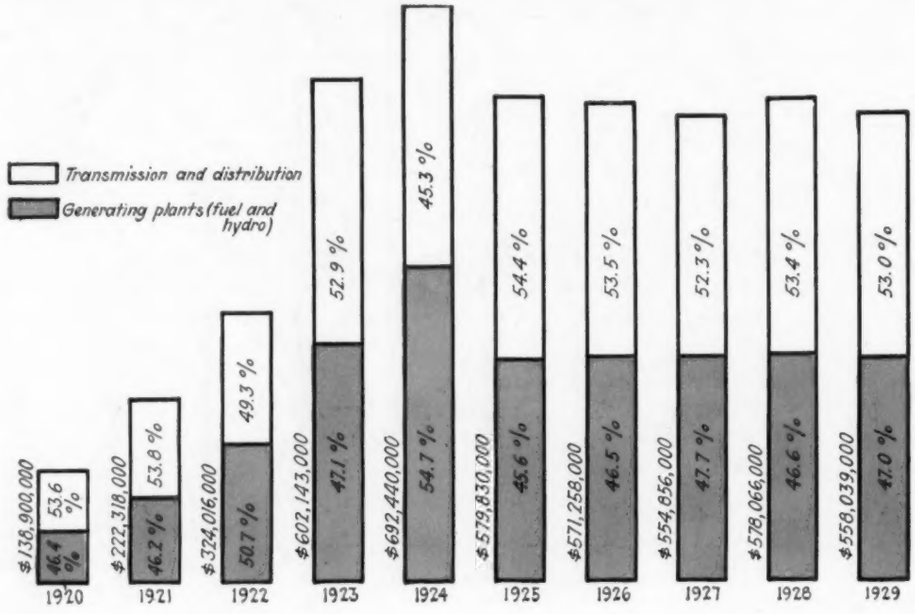
The central-station industry may well be proud of the part it has played in the economic life of America.

Economic Position of the United States and the World



Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.

Value of Additions and Extensions to Central-Station Generation and Distribution Systems



Financing the Industry's Growth

THERE is no truer gage of prosperity and growth within an industry than the amounts which are being spent for additions and extensions to the production and distribution equipment. An increase in the amount of production and distribution equipment is a direct reflection of increased demand for the product produced, which in turn is directly reflected in increased revenue to the producing company. A complete economic cycle of industrial activity.

A glance at the accompanying diagram will tell a vivid story of the growth in the operations of the electric light and power industry since the war. Back in 1920 a total of $138,900,000 was spent for additions and extensions to the central generation, transmission and distribution systems of the United States. In 1924, the peak year of construction activity, a total of $692,440,000 was spent by the central-station industry for expansion purposes, or five times the amount spent in 1920.

There were several economic reasons for this tremendous increase aside from the growth in customer energy requirements, although the amount of energy possible of sale is of course the underlying factor of the industry's growth. High money rates had much to do with the low expenditures of 1920 and low money rates for the high expenditures of 1924. In 1920 the average yield which the electric light and power companies were forced to pay on borrowed capital was more than 8 per cent, some companies borrowing at rates to yield over 9 per cent. As a result only such additions and extensions were made as were absolutely essential to take care of the most urgent needs of the industry. With the passing of the years came lower rates, until the end of 1924 found the average yield required of electric light and power bonds reduced to 5.8 per cent, and some companies paying as low as 4.6 per cent. As the yield decreased the borrowings of the industry increased, reaching the maximum in 1924. The present year has all the indications of reporting even larger borrowings than in 1924, since during the first six months of the year the financing was $140,000,000 over the same period of last year, although the financing during the remainder of the year may bring the total under 1924.

The future capital needs of the industry are of course clouded in the uncertainty of the future. Some estimates are shown in the accompanying diagram, which figures are taken from one of the reviews submitted in connection with the recent Bonbright contest. They indicate a consistent growth in the operations of the industry, although it is not believed the financing during 1925 will be as high as in 1924.